Electrical Contracting

THE MAGAZINE OF ELECTRICAL CONSTRUCTION & MAINTENANCE

IN THIS ISSUE

. . . New York labor agreement to speed housing . . . office building electrical maintenance . . . six questions, an opinion poll . . . bank lighting techniques . . . estimating branch circuit wiring for industrial lighting.

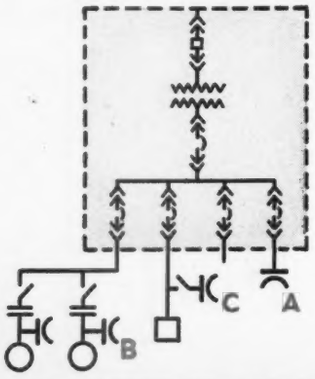
FEBRUARY • 1946

No. 2 HELPFUL HINTS ON APPLYING CAPACITORS

To help you improve power factor, reduce kva demand, increase circuit loadability and, often, reduce power costs

WHERE SHOULD CAPACITORS BE APPLIED?

The greatest *over-all* benefits can usually be obtained by installing capacitors right at the loads, because the "non-working" current is then directly reduced all the way back to the power supply. Transformers, feeders, switches, etc. are thereby enabled to handle more "working" current and to carry



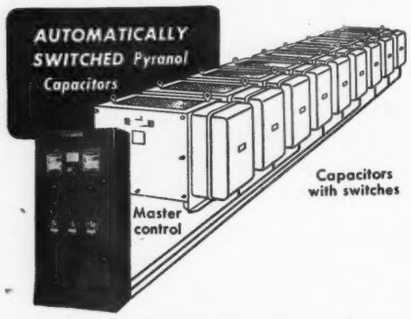
A Capacitor equipment on low-voltage bus
B Capacitors at individual loads
C Capacitor on feeder

increased useful load. Even if the present load is not to be increased, capacitors will reduce the total current, decrease losses, and raise voltage levels.

Sometimes, a single capacitor equipment or a bank of several small equipments is applied on the secondary bus as shown at (A). Less wiring, less labor, and fewer capacitors are required for such installations, but the day-in, day-out savings and other advantages are usually not as great as they are when capacitors are installed right at the load (B). An installation on an individual feeder (C) or a combination of the methods often gives best over-all results.

WHAT ABOUT OVERVOLTAGE AT LIGHT LOADS?

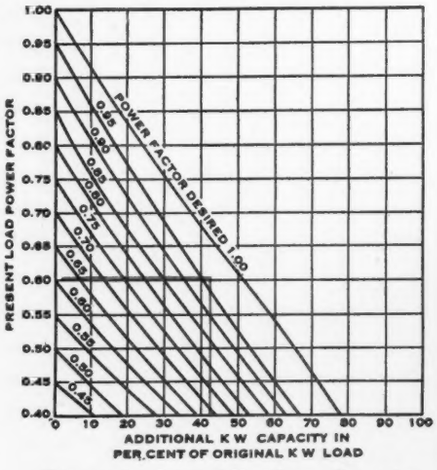
Sometimes the problem of overvoltage on a plant's circuit at *light* load limits the number of *permanently* connected capacitors that can be used. Hence, the *full* benefits of power-factor improvement at *full* load cannot be realized. To solve this problem, *automatic switching equipments* for capacitors have been developed, making it possible to add more capacitors to a given circuit. The capacitors are automatically switched on and off, in one or more groups, in response to load changes. Thus, feeder capacity can be increased at heavy loads without causing overvoltage at



light loads. As shown in the figure above, these equipments consist essentially of three major components: a bank or banks of capacitors, the switching equipment, and the automatic control equipment.

HOW TO CALCULATE THE AMOUNT OF CAPACITY YOU CAN RELEASE BY IMPROVING POWER FACTOR

With this simplified chart, you can estimate the gain in load-carrying capacity for your plant's power system.



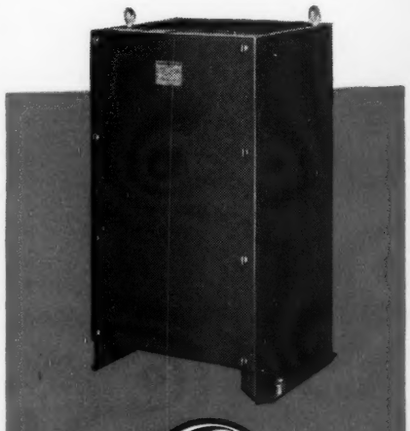
Draw a horizontal line from the point at left representing present power factor. This line will intersect the curve representing the desired new power factor. From the point of intersection, draw a vertical line to the base of the chart and read the per cent of new load which your power system can carry after the installation of capacitors.

Example (colored line): Suppose that the present power factor of a 100-kva load is 60 per cent and the desired power factor is 95 per cent. Projection of the intersection of the 60-per-cent power-factor line with the 95-per-cent power-factor curve shows that 41 per cent new load can be carried after power-factor improvement. That is, 41 kva of new load at the original power factor—60 per cent—can be added to the present system.

WHAT ARE KILOVARS?

The many different concepts of "power factor" often result in confusion. In recent years, more and more engineers have given up the lead and lag power-factor concept in favor of "two-quantity" thinking. Basically, this is merely recognition of the fact that in a-c systems two kinds of current are used—that there are two components of electrical load: (1) "working" current—producing kilowatts for power, and (2) reactive current—producing kilovars for magnetizing. By discussing the number of "kilovars" flowing "in" or "out" of a circuit much confusing terminology can be avoided. A full exposition of this subject appeared in the March 31 issue of *Electrical World*, page 64, and is also covered in G-E publications GEA-3637 and GEA-3793, available on request.

Additional capacitor *application* data can be obtained by writing for Bulletin GEA-3225A. Bulletin GEA-2742C will bring you *product* data on Pyranol capacitors for power-factor improvement. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*



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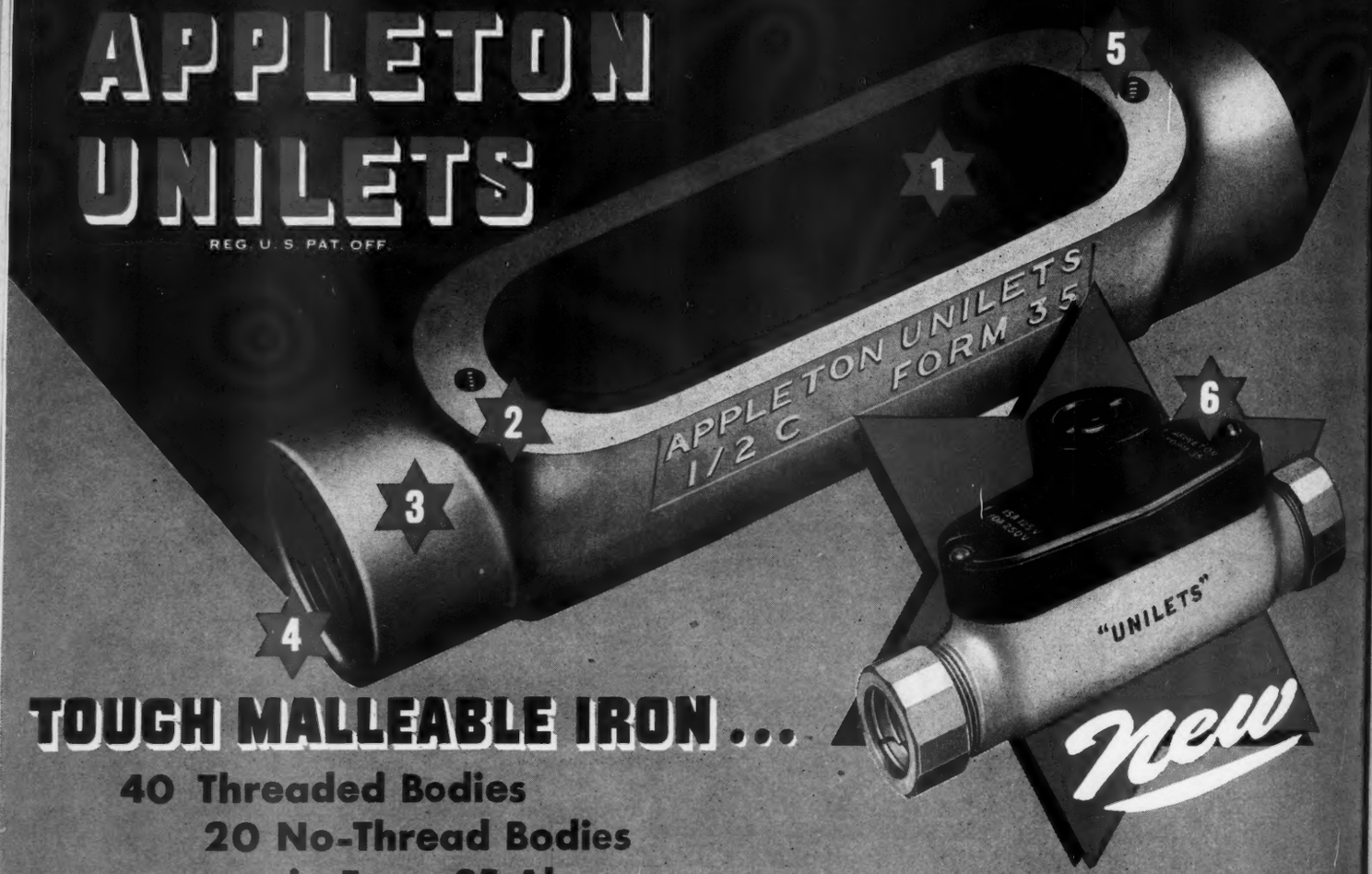

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Contents for February, 1946

February—*at a glance*..... 65

Fractionals and House Wiring..... 67

New York Agreement to Speed Housing 69
By W. T. STUART—New York electrical contractors and union to develop modern technological methods and use high speed tools and devices to speed up New York housing construction.

Office Building Maintenance..... 72
By AUGUST ECKEL—A study of an organized electrical maintenance service in Detroit's General Motors Office building.

Call Plaza 2300 for Contractor Service 76
How the electrical contractors of Baltimore have organized to assure prompt electrical service 24 hours a day.

Bank Lighting Techniques..... 79
By BERLON C. COOPER—A discussion on how light is used for architectural and decorative treatment in bank buildings.

Six Questions 82
Opinion poll of *Electrical Contracting* readers shows well defined attitudes shaping up on controversial issues.

How Much Will It Cost—Part V..... 84
By RAY ASHLEY—A discussion on estimating industrial lighting branch circuit wiring.

The Electrical War on Disease..... 88
By Dr. L. J. BUTTOLPH—A research scientist evaluates the postwar possibilities of germicidal lamps as the theory of air disinfection becomes a practicable reality.

Industrial Electrification 113
High Frequency Heating—III

Departments

Practical Methods 96
Data Sheets 101, 124
Equipment News 103
Reader's Quiz 126
Motor Shops 137
Questions on the Code.....145
Modern Lighting 151
Electronics 159
In the News.....165
Manufacturers News 182
Advertisers' Index 192

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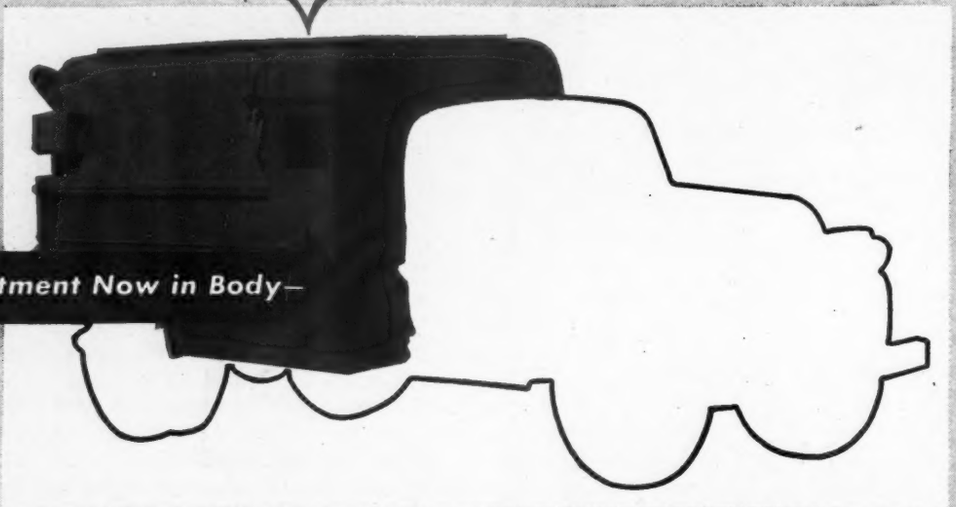

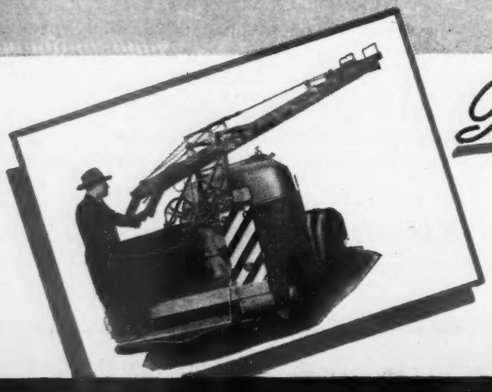

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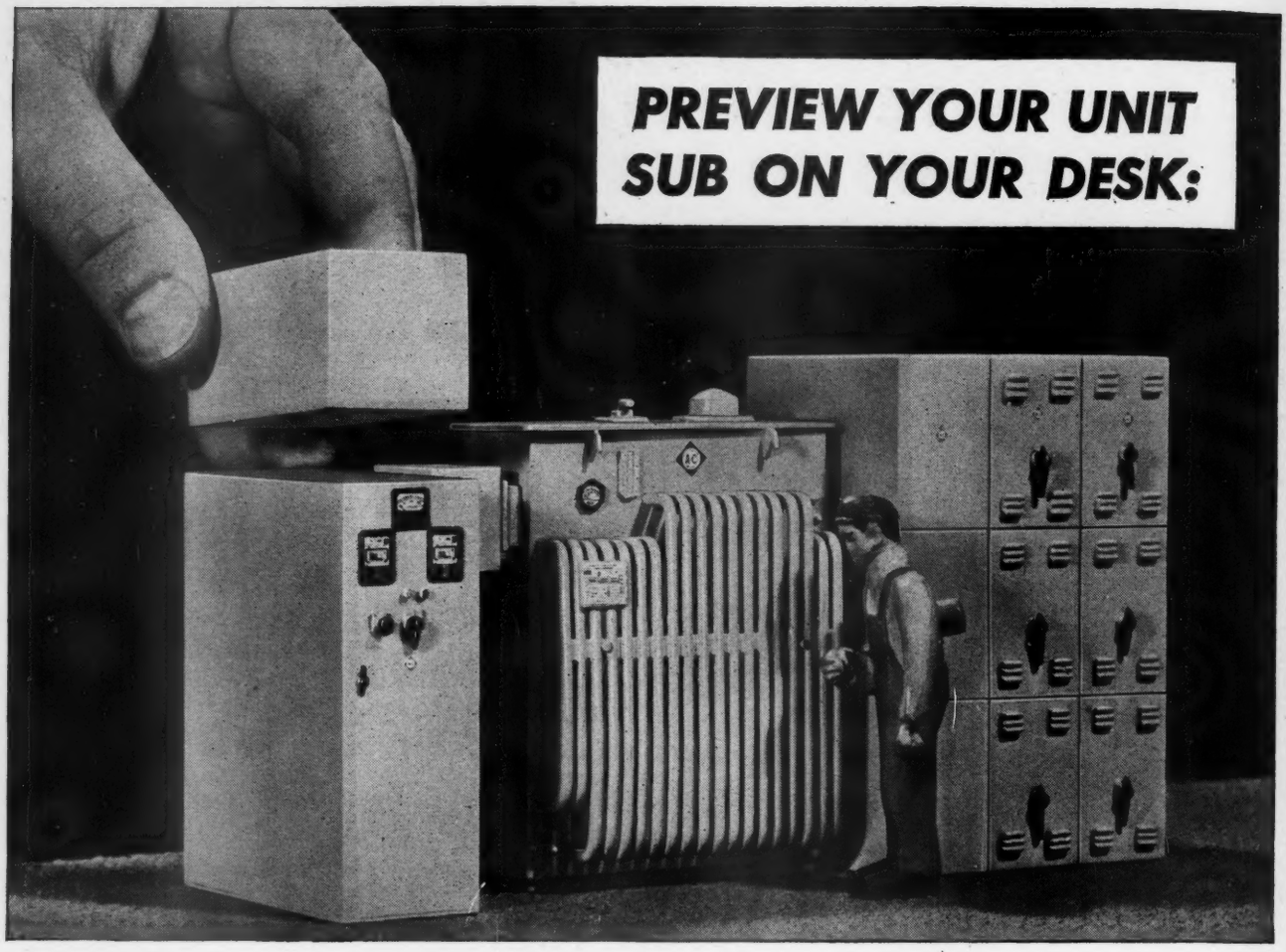

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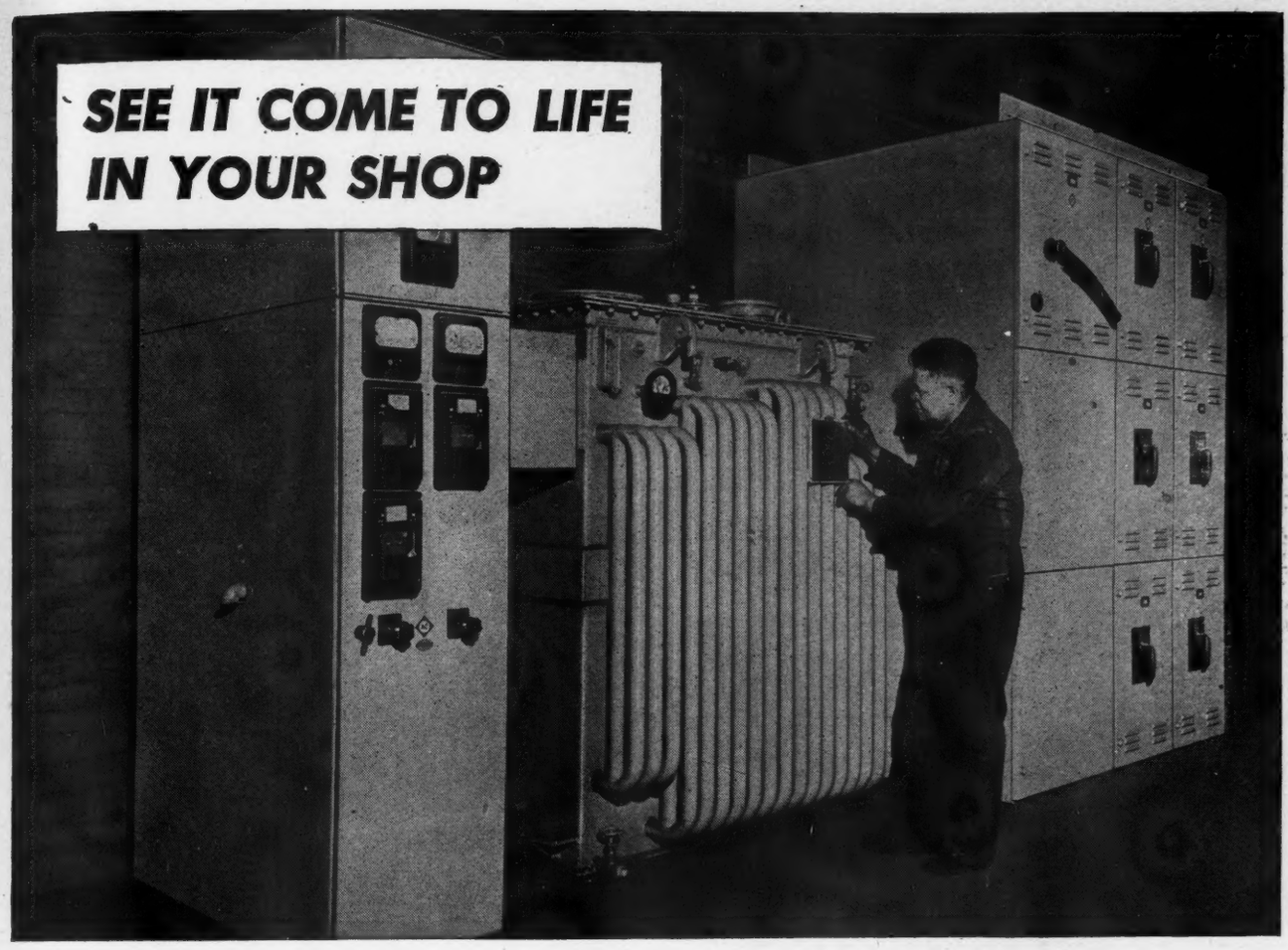

and Buy Right!

on a floor plan of your plant drawn to the same scale.

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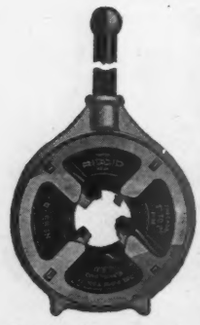

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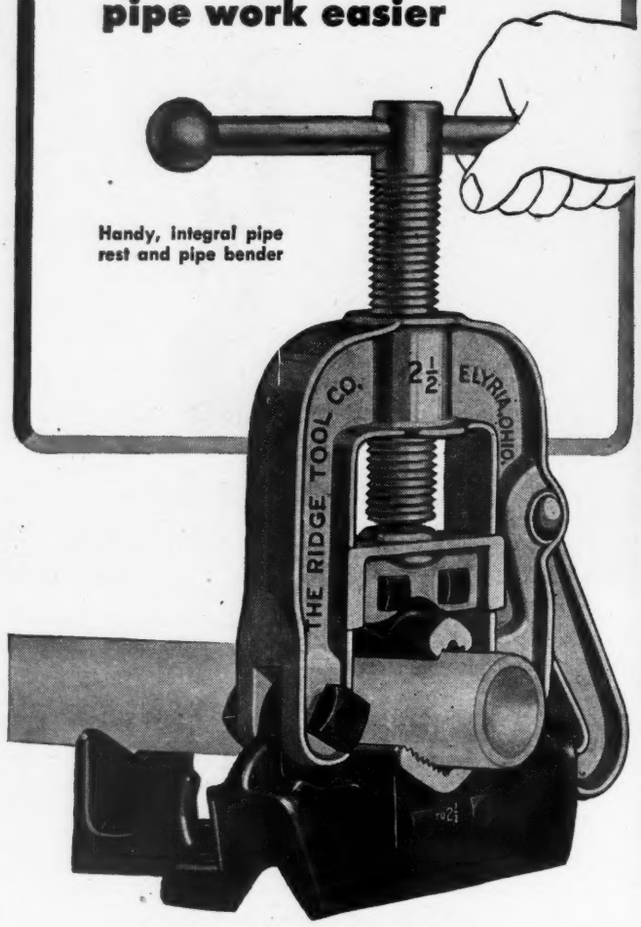

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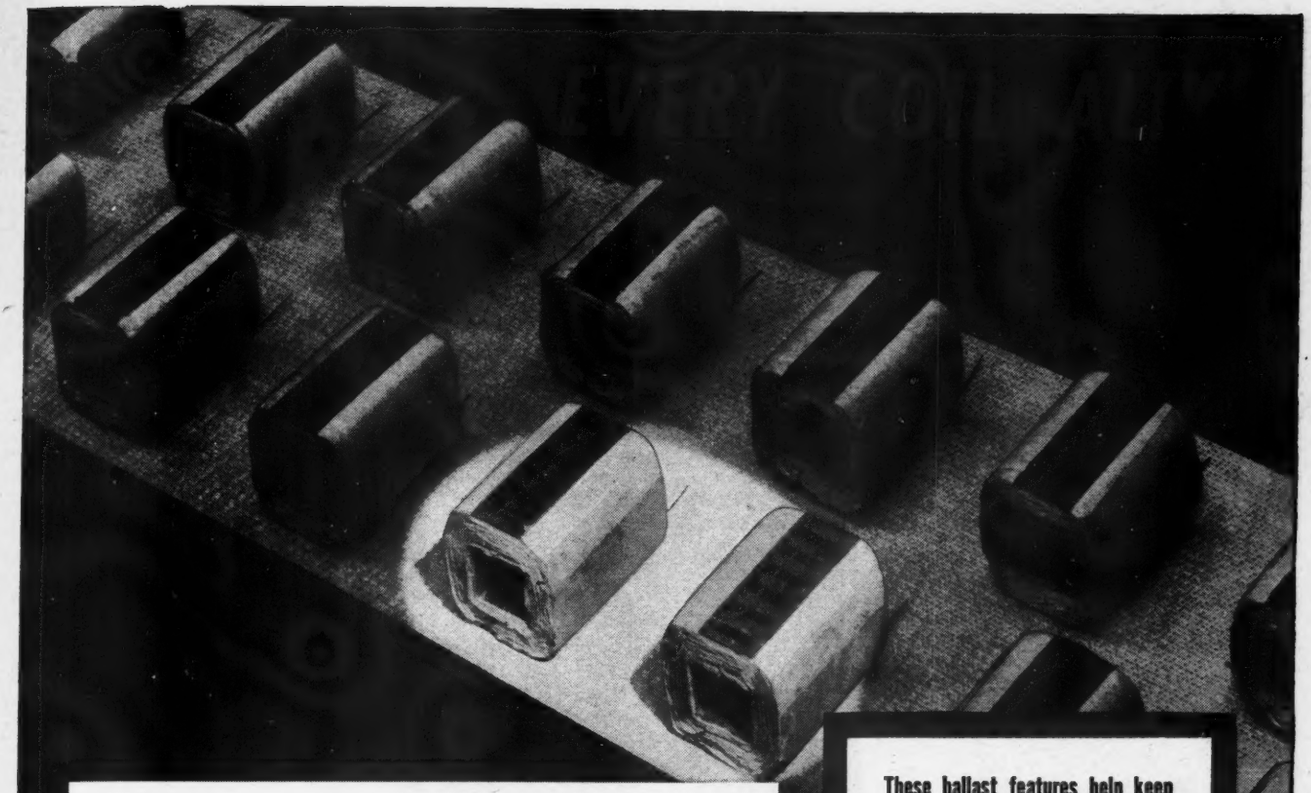

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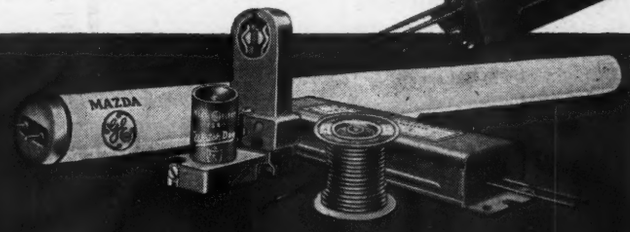

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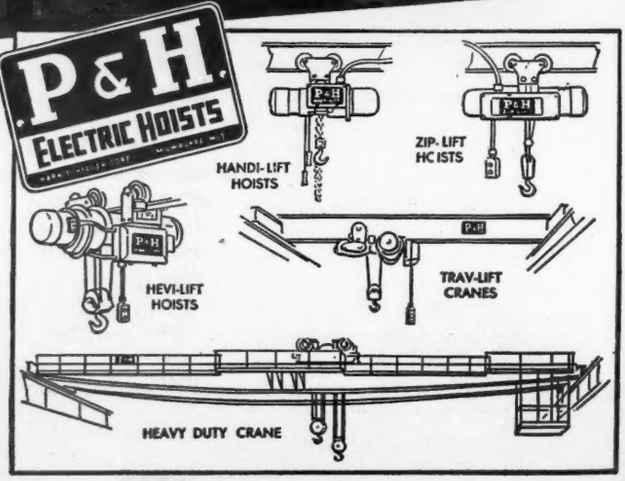

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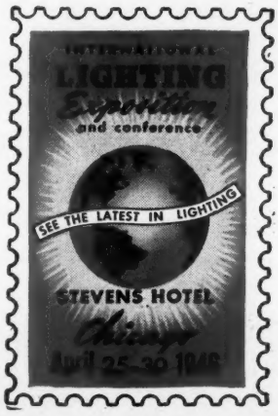


Illustrated above is an outstanding supermarket interior in which *Pittsburgh Permaflector* Incandescent and Fluorescent Equipment is used to achieve efficient illumination and a sales-stimulating overall effect. In this, and thousands of other commercial, industrial and institutional applications, *Pittsburgh Permaflector* Equipment provides the ideal answer to ALL lighting needs.

Designed to be flexible and functional, engineered to be efficient and practical . . . *Pittsburgh Permaflectors* combine ease of installation and maintenance with maximum illuminating efficiency.

For your next lighting requirements—whether for modernizing or new building—PLAN your lighting layout around *Pittsburgh Permaflector* Incandescent and Fluorescent Lighting Equipment. You will find: "There's a *Permaflector* for Every Purpose!" Consult your nearest *Pittsburgh* Lighting Engineer—or write direct. We will gladly help you put PLANNED PERMAFLECTOR LIGHTING to work for you.

Pittsburgh Permaflector

Pittsburgh Reflector Company

OLIVER BUILDING · PITTSBURGH 22, PA.

MANUFACTURERS OF PERMAFLECTOR LIGHTING EQUIPMENT

DISTRIBUTED BY BETTER ELECTRICAL WHOLESALERS EVERYWHERE

Permaflector Lighting Engineers in all Principal Cities

DC SILICONES *Keep 'em running*

—in spite of moisture

Direct connected to a centrifugal pump and repeatedly subjected to overloads, this 7½ h.p. SILICONE INSULATED motor is frequently hosed off to remove encrusted salts. It's still in service after two years. Class B insulated motors lasted only six to nine months here.

. . . plus repeated overloading for 2 years' continuous operation

By reducing motor failures caused by excessive moisture—plus heat from overloading—Silicone Insulation can cut *your* maintenance costs.

Easy to apply without special equipment, the new DC 996 Insulating Varnish bakes at 300° F., like many organic varnishes. For a complete job of Silicone Insulation, silicone bonded inorganic insulating materials are commercially available from leading distributors.

There's a cost-saving place for Silicone Insulation wherever insulation failures result from repeated overloads, excessive moisture, and exposure to chemical dust, fumes, and most chemicals. For full details, contact Dow Corning.

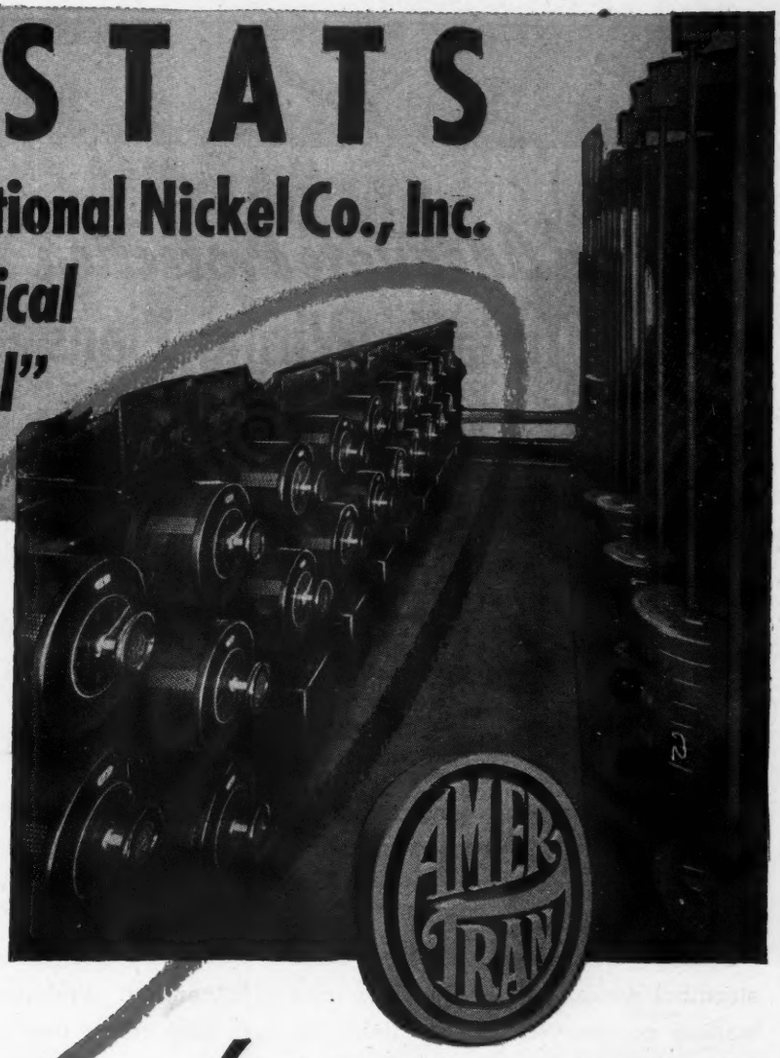
DOW CORNING CORPORATION
MIDLAND, MICHIGAN

Cleveland Office: Terminal Tower • Chicago Office: Builders' Building
New York Office: Empire State Building
In Canada: Silicone Products Division, Fiberglas Canada, Ltd., Toronto

Dow Corning
FIRST IN SILICONES

TRANSTATS

used by The International Nickel Co., Inc. for "...close electrical temperature control"



In this research laboratory at Bayonne, N.J., Transtats are used to control elevated temperatures in "creep testing" of alloys for high temperature applications. Since these tests are continuous over long periods, a high degree of reliability and accurate control are essential. The Transtats in conjunction with automatic controllers, connected to resistance heaters, keep the temperature at the required degree within close limits.

For a continuously adjustable voltage or a constant voltage from a fluctuating source, specify Transtats.

6 TRANSTAT "EXTRAS"

1. **Potentiometer smoothness** with transformer efficiency (93-99%)
2. **High turn-to-turn insulation** and solid insulating material between commutator bars—a combination of extra wire insulation and varnish impregnation of core and coil.
3. **Broad, Uniform Commutating Surface** ground from the evenly spaced outer wires of the coil.
4. **Smooth Commutating Surface.** Velvety action—no arcing—every turn a perfect contact.
5. **Longer Brush—more contact area,** reducing current density and providing greater area for heat dissipation.
6. **Balanced Collector Arm** maintains brush setting at any degree of mounting.

AMERTRAN

MANUFACTURING SINCE 1901 AT NEWARK N. J.

AMERICAN TRANSFORMER COMPANY
178 Emmet Street • Newark 5, New Jersey

Pioneer Manufacturers of Transformers, Reactors and Rectifiers for Electronics and Power Transmission

FOR SAFETY'S SAKE . . . USE CONDUIT *(Full Weight Rigid Steel)*

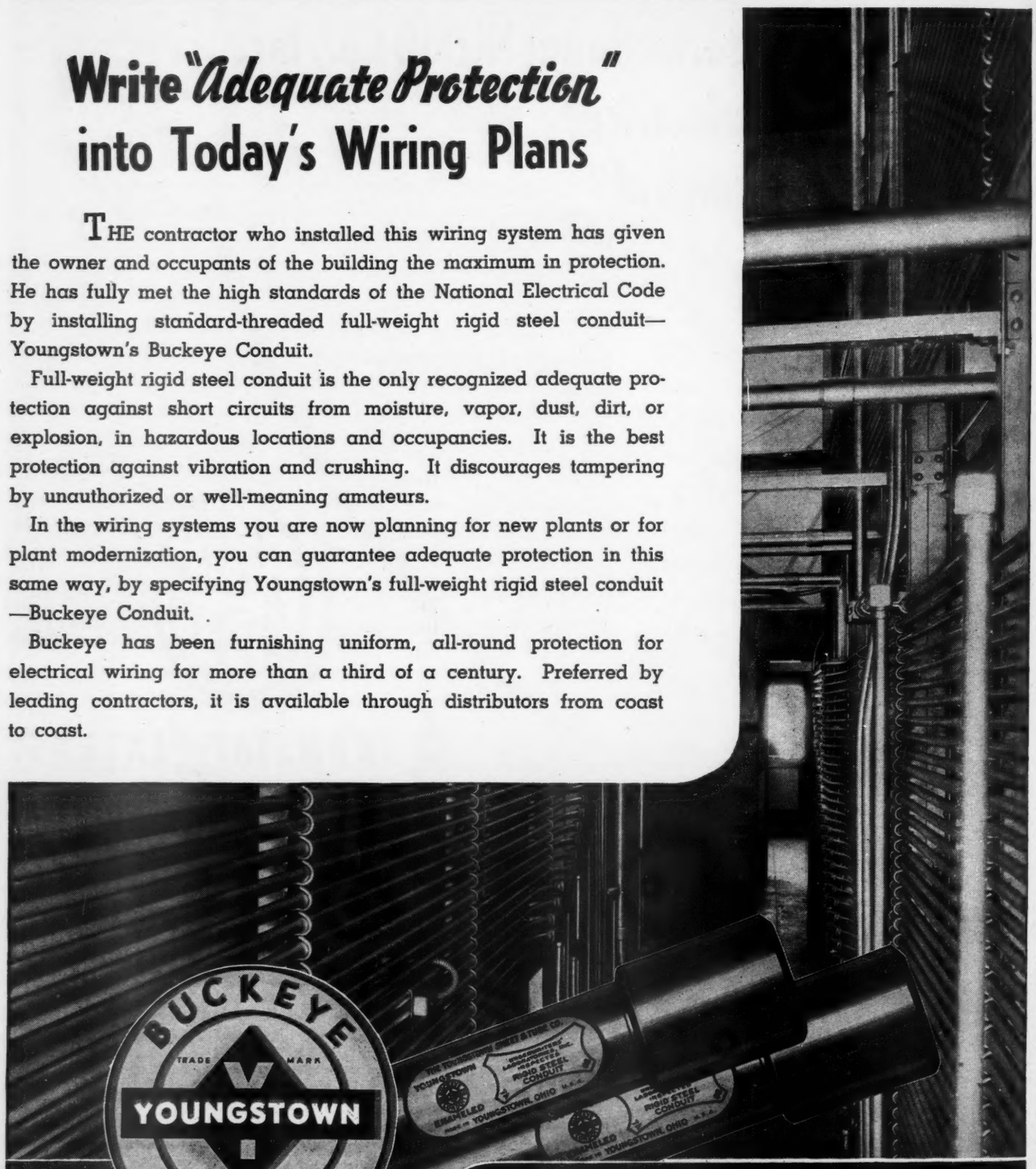
Write "Adequate Protection" into Today's Wiring Plans

THE contractor who installed this wiring system has given the owner and occupants of the building the maximum in protection. He has fully met the high standards of the National Electrical Code by installing standard-threaded full-weight rigid steel conduit—Youngstown's Buckeye Conduit.

Full-weight rigid steel conduit is the only recognized adequate protection against short circuits from moisture, vapor, dust, dirt, or explosion, in hazardous locations and occupancies. It is the best protection against vibration and crushing. It discourages tampering by unauthorized or well-meaning amateurs.

In the wiring systems you are now planning for new plants or for plant modernization, you can guarantee adequate protection in this same way, by specifying Youngstown's full-weight rigid steel conduit —Buckeye Conduit.

Buckeye has been furnishing uniform, all-round protection for electrical wiring for more than a third of a century. Preferred by leading contractors, it is available through distributors from coast to coast.



Ask your distributor for:
Youngstown Buckeye Conduit-Pipe and Tubular Products - Sheets - Plates - Electrolytic Tin Plate-Coke Tin Plate-Bars-Rods-Wire-Nails-Tie Plates and Spikes.

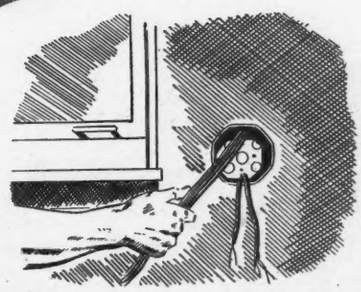
YOUNGSTOWN
THE YOUNGSTOWN SHEET AND TUBE COMPANY
YOUNGSTOWN, OHIO
Manufacturers of
CARBON - ALLOY AND YOLOY STEELS

The Burning Question– *knocked cold!*

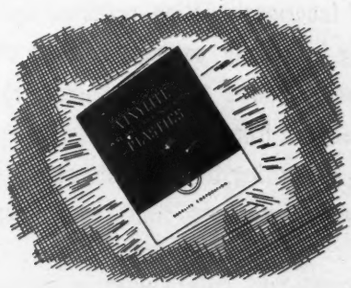
DANGER in crowded assemblies? . . . in compactly grouped conductors in close cabinets? Today you can eliminate one fire hazard in such installations, for properly formulated wire and cable insulation of VINYLITE plastics is *non-flammable!* This modern insulation performed invaluable wartime service in marine, aircraft, and radio use. Now you can adopt it as a dependable safeguard in built-up forms and a wide range of critical applications.

Availability in non-flammable form is *one* notable feature of VINYLITE plastic insulation. Its sum total of properties, however, make it your outstanding specification for wires and cables, indoors and out. Extremely flexible, it is ideal on moving mechanisms. On overhead lines it is outstandingly resistant to weathering and the effects of sunlight. In underground installations it affords superlative protection against acid and alkaline soils.

THEY'RE COILED, PULLED, twisted, and walked on! But VINYLITE plastic insulation gives cords for household appliances and portable tools both maximum dependability and service life. Extremely tough, this modern insulation is highly resistant to abrasion, impact, grease, alkalies, most acids, and aging. Some types are non-flammable, others slow burning. Its dielectric strength permits the thin-wall construction that means light weight and ease of handling. Bright and pastel colors lend added appeal to many consumer items.



YOU CAN MODERNIZE old buildings with utmost economy – double the number of circuits in existing conduits – by installing wires with thin-wall, small-diameter VINYLITE plastic insulation. And of course every *new* building merits the extra safety, dependability, and long life of this superlative insulation. The non-flammable types bring maximum security from damage by fire. All types are highly resistant to alkalies, oils, grease, and most acids, and all have an unusually low rate of water absorption.

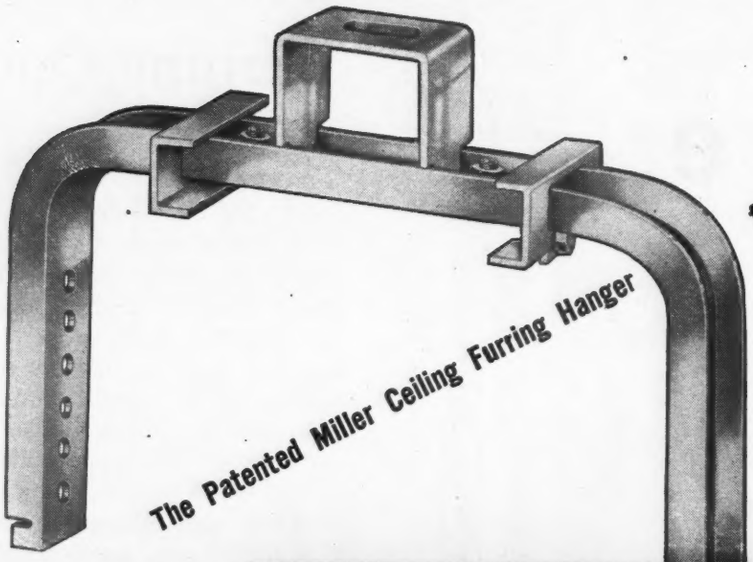


WRITE DEPARTMENT 28-1V for booklet W-4, "VINYLITE Plastics for Wire and Cable Insulation." It shows typical applications and the specific advantages of this insulation in the public utility, communications, industrial, and construction fields, and for marine, radio, and aircraft applications. Bakelite engineers are also ready at all times to help you determine how VINYLITE plastic insulation can best be used, technically and economically, for present projects and those still in the planning stage.

VINYLITE
TRADE-MARK
PLASTICS

BAKELITE CORPORATION, *Unit of Union Carbide and Carbon Corporation* UCC 30 EAST 42ND STREET, NEW YORK 17, NEW YORK

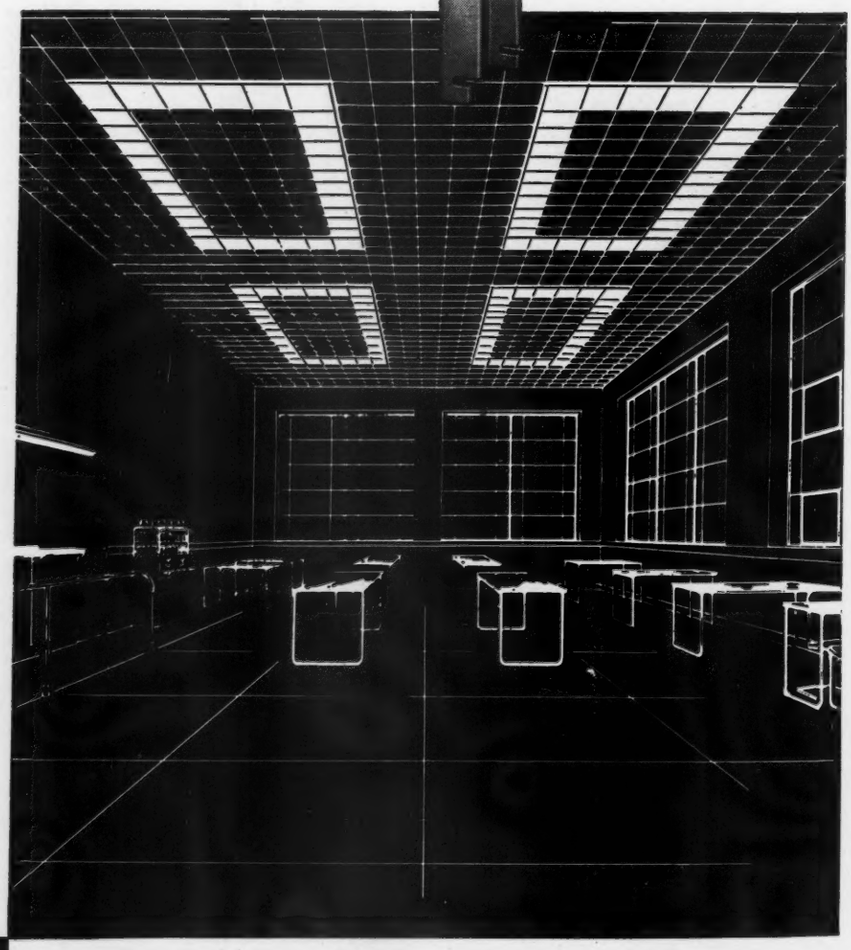
Backbone of CEILINGS UNLIMITED



The Miller Fluorescent Troffer Lighting System is truly versatile. It suggests new themes. Its many practical applications offer CEILINGS UNLIMITED.

The patented Miller Ceiling Furring Hanger is the backbone of this lighting system. It eliminates the necessity of laboriously fitting recessed lighting into hung ceilings. Instead one simply hangs Miller Ceiling Furring Hangers from the structural Ceiling —and furring, tile and Troffer Lighting System are hung from the Hangers.

Structurally outstanding in its simplicity, its advantages are many— including economy of installation, more "above ceiling space" for piping and air conditioning ducts and assurance of a really level ceiling. Miller representatives are in principal cities.



MILLER
SINCE 1844

THE MILLER COMPANY • MERIDEN, CONNECTICUT

ILLUMINATING DIVISION
Fluorescent, Incandescent
Mercury Lighting Equipment

ROLLING MILL DIVISION
Phosphor Bronze and Brass
in Sheets, Strips and Rolls

FOUNDRY DIVISION
Non-Ferrous Metal
Castings

HEATING PRODUCTS DIVISION
Domestic Oil Burners
and Liquid Fuel Devices

reconvert "Qikly"

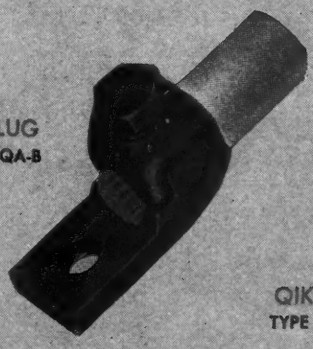
with **Burndy**

QIKLINE CONNECTORS

Install quickly with an ordinary wrench —cast of high strength, high copper alloy—high compression contact assured by oversize studs—each size takes broad range of cable sizes—Send for CATALOG # 41. Burndy Engineering Co., Inc., 107D Bruckner Blvd., New York 54, N. Y.

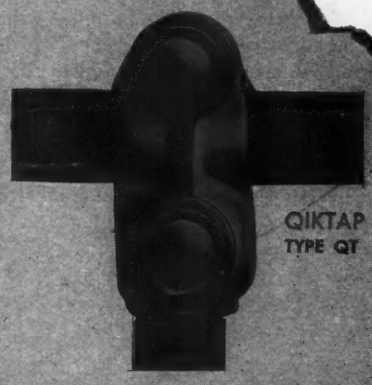
QIKLUG
TYPE Q3A-B

QIKLINK
TYPE QR-B



QIKLUG
TYPE QA-B

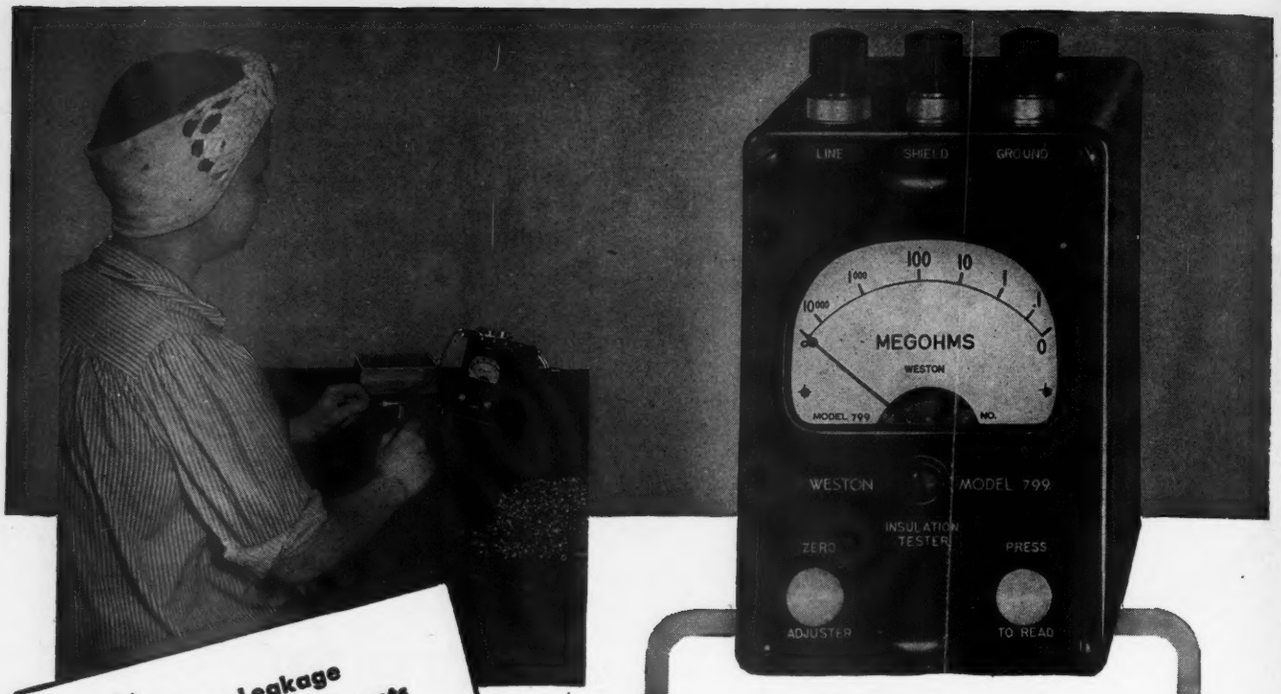
QIKSTUD
TYPE Q2DN



QIKTAP
TYPE QT

Headquarters for CONNECTORS

Burndy



Now . . . **Leakage Resistance Measurements at Low Potentials!**

Because of its compactness and extreme high sensitivity, this direct reading instrument fills an important measurement gap in the production and servicing of a wide variety of components and electrical devices. Minute faults can be detected *in advance* . . . tests can be made without destructive breakdown. Test potential less than 50 Volts.

Here's what a few typical users say about Model 799:

"We use it for testing the leakage between windings in transformers, or from windings to core or case."

"We can test the leakage of low voltage paper and mica condensers with the 799, and without danger of damaging the dielectric."

"We test leakage resistance between individual wires in cable harnesses."

"Model 799 is also ideal for checking leakage due to moisture in fiber terminal strip."

For complete data on Model 799 Insulation Tester, communicate with the WESTON representative in your locality, or write...Weston Electrical Instrument Corporation, 672 Frelinghuysen Ave., Newark 5, N.J.

Weston

MODEL 799
INSULATION TESTER

• 10 BILLION Ohms •

will measure:

- Insulation Properties
- Resistance Leakage
- Conductivity of Insulating Materials
- Leakage due to Moisture Absorption
- Readings — .1 to 10,000 megohms

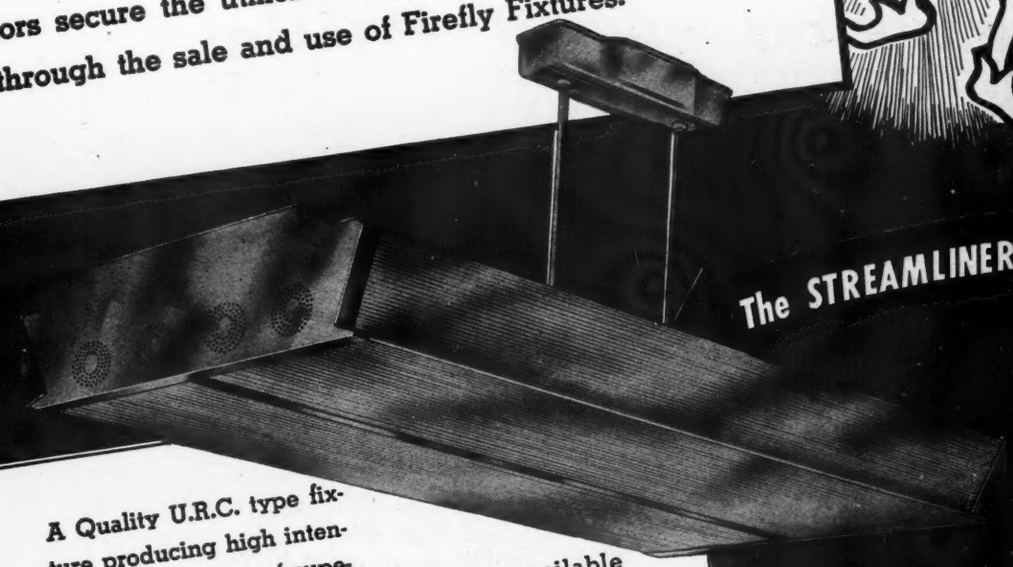
Weston *Instruments*

ALBANY • ATLANTA • BOSTON • BUFFALO • CHICAGO • CINCINNATI • CLEVELAND • DALLAS • DENVER • DETROIT • JACKSONVILLE • KNOXVILLE • LOS ANGELES • MERIDEN
MINNEAPOLIS • NEWARK • NEW ORLEANS • NEW YORK • PHILADELPHIA • PHOENIX • PITTSBURGH • ROCHESTER • SAN FRANCISCO • SEATTLE • ST. LOUIS • SYRACUSE
In Canada, Northern Electric Co., Ltd., Powerlite Devices, Ltd.

Freddy Firefly is "Quality Conscious"

"Quality" is built right into this already famous line. For the Firefly line is "Made Right . . Priced Right . . Sells Right." Wholesalers from coast to coast endorse the wisdom of this policy.

And, because the Firefly line is sold only to accredited electrical jobbers, both the wholesalers and contractors secure the utmost co-operation and satisfaction through the sale and use of Firefly Fixtures.

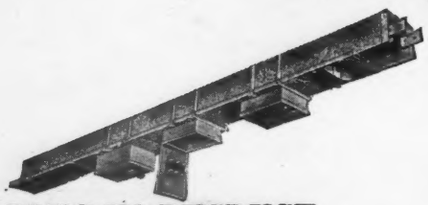


A Quality U.R.C. type fixture producing high intensity diffused light of superior quality and low brightness . . . available with ballasts or Insta-Start transformers. Packed in our NEW Engineered Carton.

KAHN MFG. CO. INC.

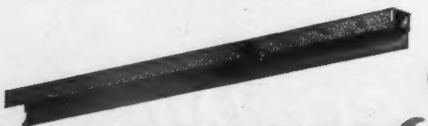
THAT'S THE TIME TO INSTALL

Busduct



PLUG-IN BUSDUCT

FEEDER BUSDUCT



WIRE AND CABLE DUCT

When you plan changes in the plant layout are you handicapped by an inadequate power distribution system? Does moving machines involve tearing up and restringing long, expensive wiring? Is heavy equipment forced to locate near the power source?

The answer to all these questions is "NO"— once FA BUSDUCT is installed. It provides *Plug-in* power source every foot of its length . . . enables machines to be running in *minutes* after locating . . . eliminates "cobweb" wiring systems, gives the plant layout unlimited flexibility for efficient work flow.

And FA Busduct *never* loses its value. Standard 10-foot sections assemble and dismantle speedily, permit extensions and step-down capacity tap-offs, and furnishes maximum efficiency in power distribution.

Our 20-page Bulletin No. 65 was made to help you with your planning. It gives specifications, prices and many helpful suggestions. Write for it today.

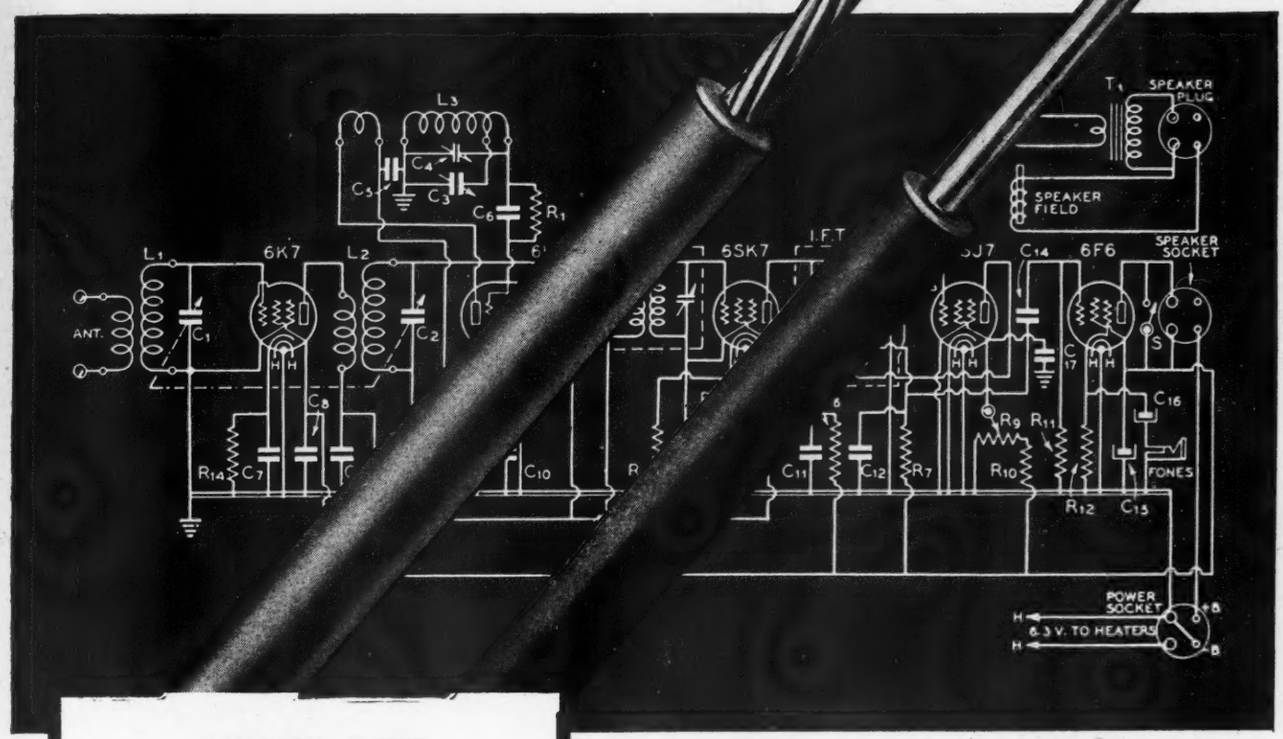
Frank Adam

ELECTRIC COMPANY

Makers of Busduct Panelboards • Switchboards

BOX 357, ST. LOUIS, MISSOURI

Specify Federal RADIO HOOK-UP WIRE



LONG LIFE

FLAME RESISTANT

LOW MOISTURE ABSORPTION

RESISTS OXIDATION

HIGH DIELECTRIC STRENGTH

WIDE COLOR RANGE

THERMOPLASTIC INSULATION

FOR SUPERIOR QUALITY AND SERVICE

Federal's light-weight, pliable, thermoplastic insulated hook-up wire . . . fitted to your job . . . means better assembly with wire possessing superior dielectric strength and exceptional mechanical stamina.

Resistant to flame, moisture and oxidation . . . this tough but flexible thin-walled thermoplastic insulation covers all Federal's hook-up wire and combats aging, water absorption, abrasion, oils and greases.

Available in solid or stranded types . . . for high or low voltage needs in radio, electronics, appliances, communications, and allied fields . . . these labor-saving light-weight hook-up wires come in 14 brilliant colors and range in size from 24 to 14.

Whether your needs be large or small, get complete details . . . write to Federal now.

Federal Telephone and Radio Corporation

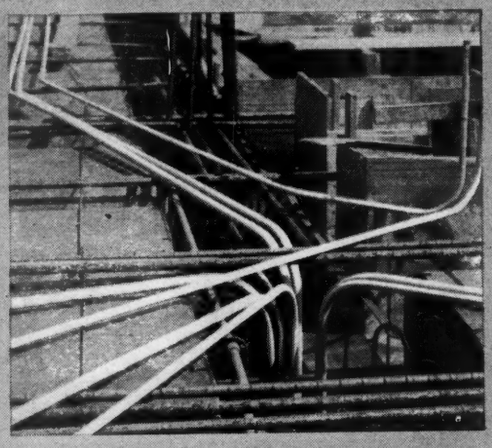
Export Distributor:
International Standard Electric Corporation

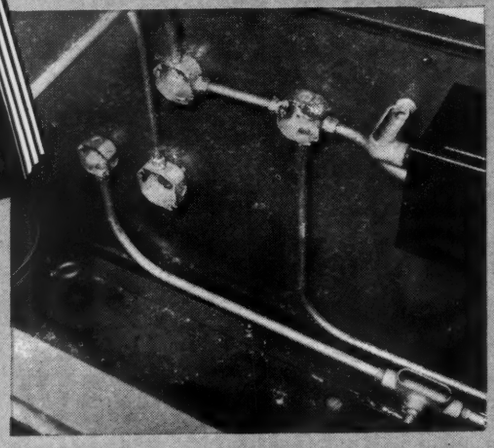
AN IT&T ASSOCIATE

Newark 1, N. J.

LIKE THE KITCHEN

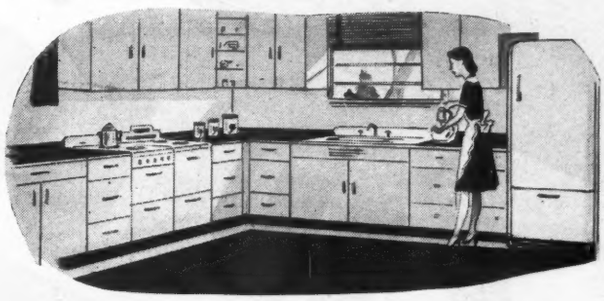
Electrical Raceways





This informative 68-page book contains concise directions and helpful diagrams for making all types of standard conduit bends with ELECTRUNITE E.M.T. *and the patented, one-piece* ELECTRUNITE *Bender. If you do not already have a copy, write for yours today.*

have gone modern, too!



ELECTRUNITE E.M.T. is the UP-TO-DATE RACEWAY for OPEN, CONCEALED or CONCRETE SLAB CONSTRUCTION

Gone are the days of the barn-like kitchen with the heavyweight cooking utensils and massive coal-burning stove. And just as a modern kitchen design calls for safety, convenience and time-saving efficiency, so, too, does a modern electrical raceway installation.

Republic ELECTRUNITE E.M.T. is lightweight, Inch-Marked*, easy-to-bend and threadless. It is approved by the National Electrical Code for exposed, concealed or concrete slab construction. And it offers adequate electrical and mechanical protection as determined by Underwriters' Laboratories.

Inch-Marking consists of easy-to-read inch and foot marks along every length of tubing.

*Reg. U. S. Pat. Off.

It eliminates the need for trying to hold a flat rule against the conduit.

With modern ELECTRUNITE E.M.T., dirty, tedious thread-cutting is eliminated. Two simple compression-type fittings—easily installed with a wrench or a pair of pliers—make strong, watertight joints in a hurry. Moreover, standard adapters make it easy to combine ELECTRUNITE E.M.T. with existing threaded installations and fittings.

For complete details about this up-to-date rigid steel conduit, see your local Republic ELECTRUNITE Distributor or write directly to:

REPUBLIC STEEL CORPORATION
STEEL AND TUBES DIVISION • CLEVELAND 8, OHIO
Export Department: Chrysler Building, New York 17, N. Y.

Republic
ELECTRUNITE E.M.T.
REG. U. S. PAT. OFF.
LIGHTWEIGHT THREADLESS RIGID STEEL CONDUIT

For Large Areas..

CHELSEA VENTILATING COOLERS

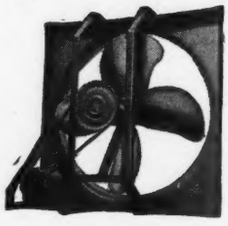
..and Small!

..available now to meet your needs!

Whatever your ventilating problem—factory, hotel, office or home — CHELSEA equipment provides the economical solution. All types of industrial units are included in a diversity of sizes as well as many domestic models. All are specifically designed for maximum service life and quiet, efficient operation.

CHELSEA exhausters, blowers, coolers, fans and ventilators—incorporate the skill and experience of 30 years' specialization in the field. All are described in detail in illustrated literature, available on request without obligation. Write today.

A



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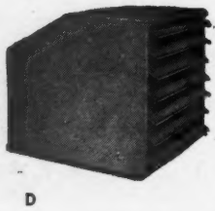

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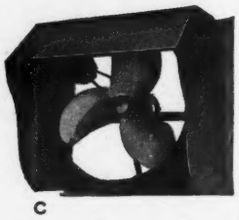


C

(A)—TYPE D X B SPRAY BOOTH EXHAUSTER

(B)—TYPE ED GENERAL PURPOSE ATTIC FAN

(C)—TYPE AP APARTMENT WINDOW VENTILATING FAN

(D)—TYPE PH PENTHOUSE ROOF VENTILATOR

CHELSEA

CHELSEA PRODUCTS

INCORPORATED

1206 GROVE STREET

IRVINGTON, NEW JERSEY

The extensive line of

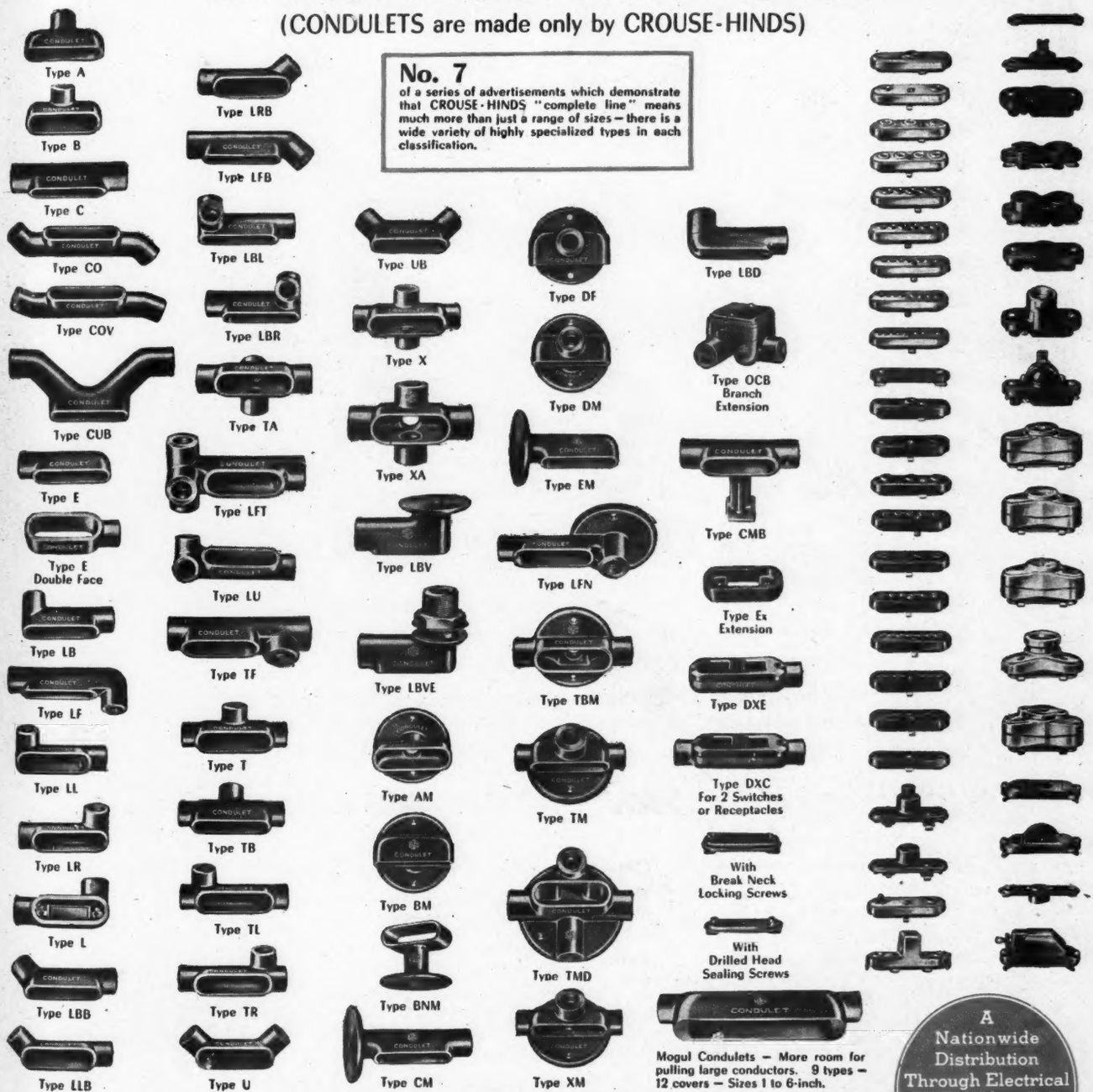
Obround CONDULETS

simplifies your installation problems.

51 types of bodies — sizes 1/8 to 6-inch — a wide selection of interchangeable covers and wiring devices.

(CONDULETS are made only by CROUSE-HINDS)

No. 7
of a series of advertisements which demonstrate that CROUSE-HINDS "complete line" means much more than just a range of sizes — there is a wide variety of highly specialized types in each classification.



Complete listings of each type are in Condulet Catalog No. 2500

A Nationwide Distribution Through Electrical Wholesalers

CROUSE-HINDS COMPANY

Syracuse 1, N. Y., U.S.A.

Offices: Birmingham — Boston — Buffalo — Chicago — Cincinnati — Cleveland — Dallas — Denver — Detroit — Houston — Kansas City — Los Angeles — Milwaukee — Minneapolis New York — Philadelphia — Pittsburgh — San Francisco — Seattle — St. Louis — Washington. *Resident Product Engineers:* Albany — Atlanta — Charlotte
CROUSE-HINDS COMPANY OF CANADA, LTD., *Main Office and Plant:* TORONTO, ONT.

CONDULETS · TRAFFIC SIGNALS · AIRPORT LIGHTING · FLOODLIGHTS

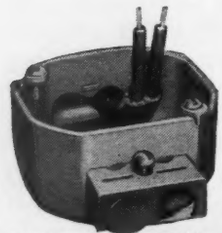
Say, Toots, WHO'S DIS RACO Fella?

• 'Tisn't a fella, Tony. As most builders, contractors, and architects know, RACO is the trade-mark of All-Steel's complete line of *better* switch boxes and outlet boxes.

BETTER—AND HERE'S WHY:

- No jagged or rough edges—no dirt or grease. Smooth, attractive appearance!
- Every Raco product comes to you in attractive carton . . . shows product number, quantity, finish.
- All-Steel has been making precision products for over 33 years. The Raco line is *uniformly* made to the same exacting standards.

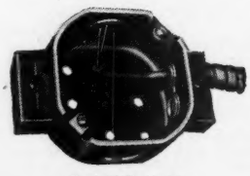
Get acquainted with this dependable line today. Remember, it's the quality line that's sold nationally through wholesalers only.



For Non-Metallic Cable

THE JAY-KAY (J-K) BOX

Made for "BX" but with bushing plate removed, it becomes a box for non-metallic cable. Supplied in 3¼" and 4" diameters. Boxes only, or assembled on bars; external clamps allow more wiring room. Use this box now when connectors are scarce.

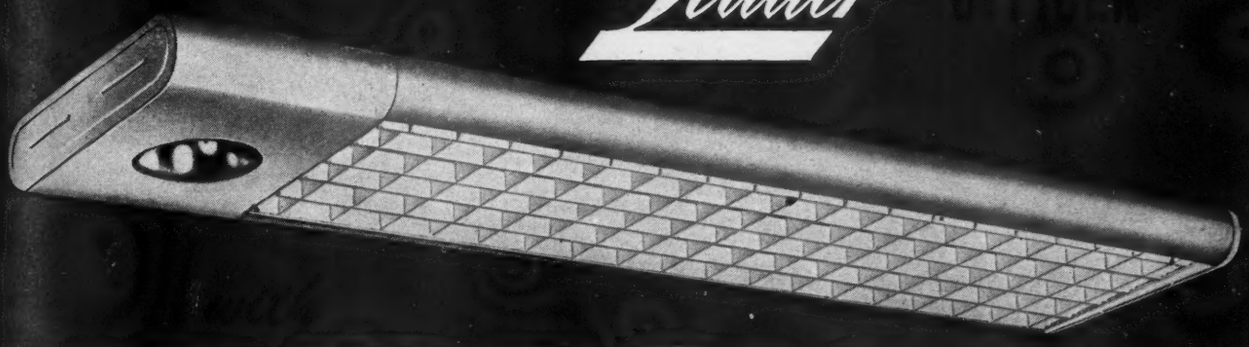


For BX Cable

ALL-STEEL-EQUIP COMPANY, INC.
600 Kensington Avenue, Aurora, Illinois

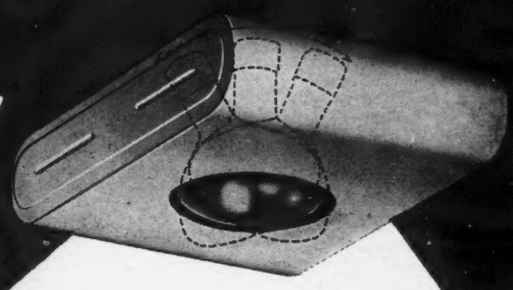
RACO • ALL-STEEL • PRODUCTS
SWITCH BOXES • OUTLET BOXES

Leader



"DIRECLITE"

"Spot"



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combining utility and
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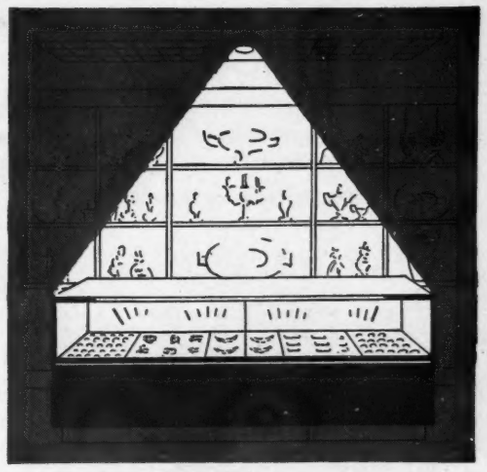
Distributed only through the Better Electrical Wholesalers



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Leader **ELECTRIC MANUFACTURING CORP.**

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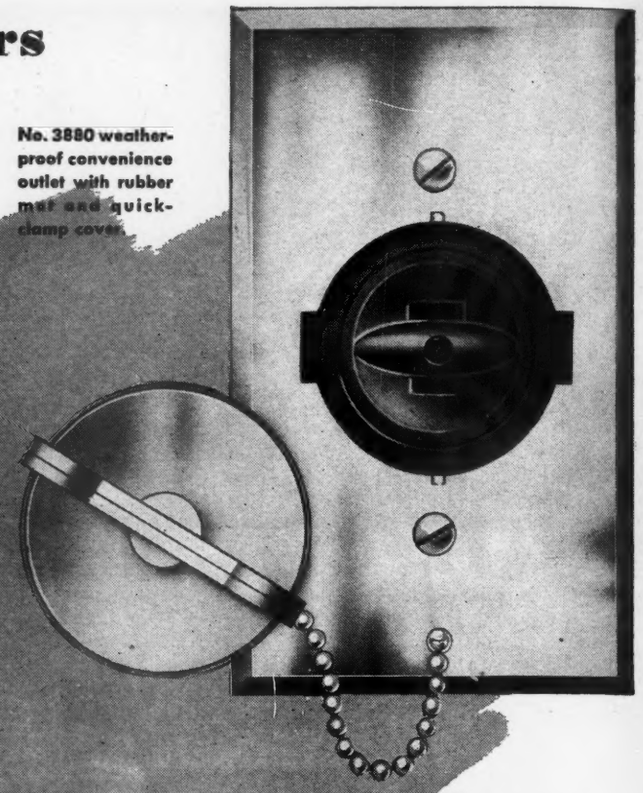
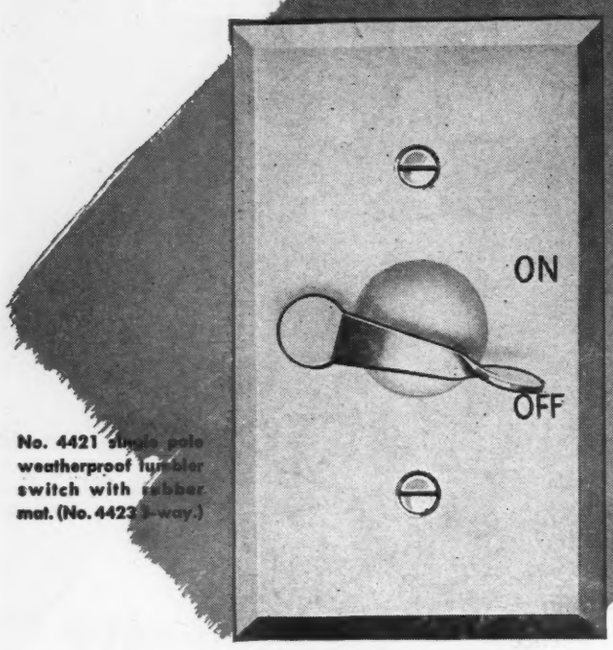
Look for Wiring Dollars Outdoors with • • •

BRYANT WEATHERPROOF DEVICES



No. 3880 weatherproof convenience outlet with rubber mat and quick-clamp cover.



No. 4421 single pole weatherproof tumbler switch with rubber mat. (No. 4423 3-way.)

Home magazines today are saying a lot about the new era of "electrical living." They also point out the noticeable trend toward more and more "outdoor living." Smart builders and architects are combining both by providing *electrical living outdoors.*

Bryant weatherproof wiring devices are ideally suited for this development. Typical of the complete Bryant line, are the weatherproof tumbler switch (Catalog No. 4421) and the weatherproof outlet with its quick-clamp cover (Catalog No. 3880) illustrated here. The switch is also available in a 3-way type (No. 4423). Completely protected from moisture, these devices provide dependable outdoor service.

Recommend, sell and install these weatherproof devices for screened porches, terraces, outdoor fireplaces and the like to connect lamps, toasters, grills, mixers, bug killers, Christmas lights and other conveniences. And don't overlook the farm market where outdoor lights and electrical apparatus require weatherproof switches and outlets. Look for wiring dollars outdoors!

THE BRYANT ELECTRIC COMPANY

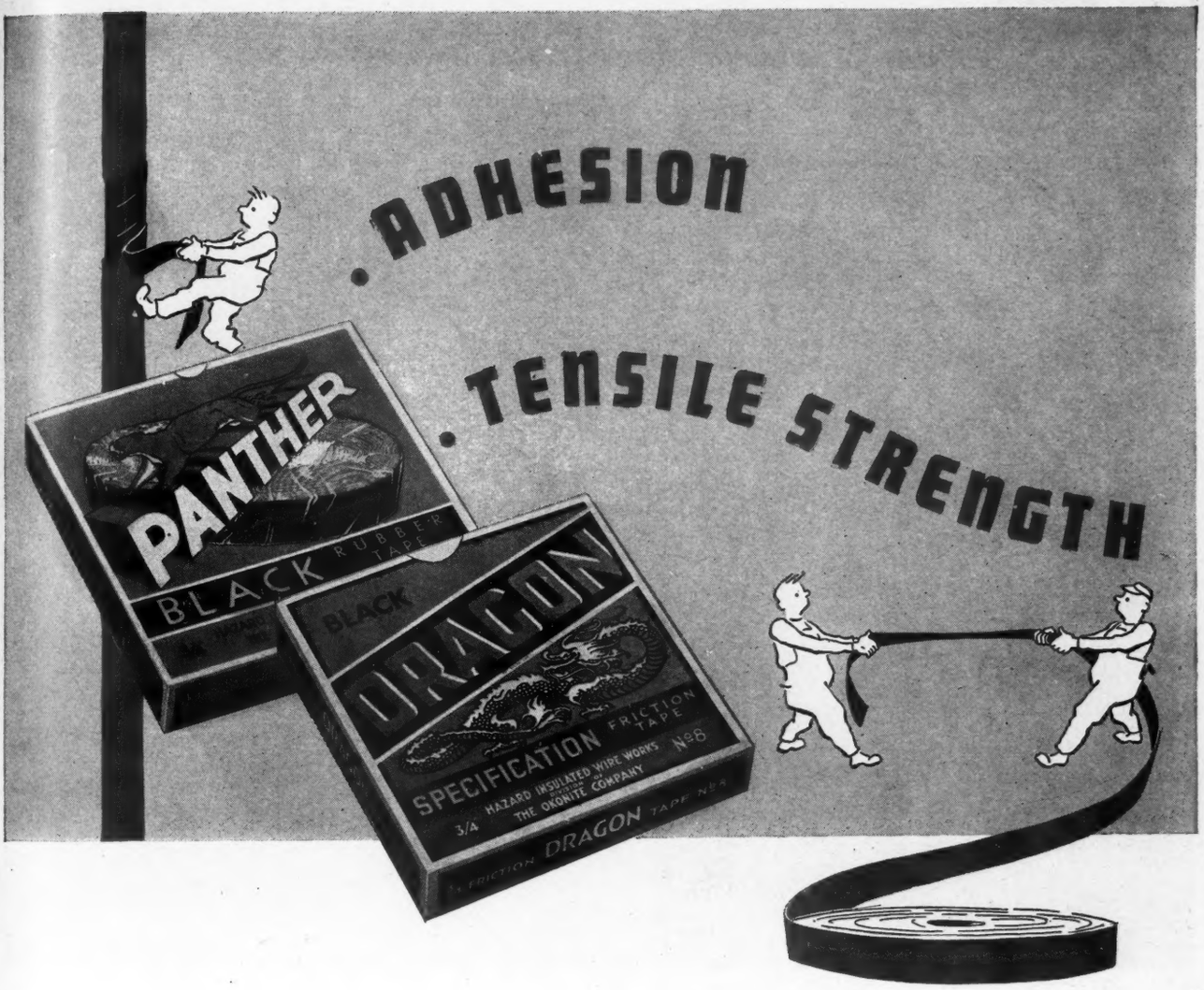
SUPERIOR WIRING DEVICES

BRIDGEPORT 2, CONNECTICUT

NEW YORK SAN FRANCISCO CHICAGO LOS ANGELES

A SUBSIDIARY OF WESTINGHOUSE ELECTRIC CORPORATION

Specify Bryant Devices from your Electrical Wholesaler



These are two of the performance factors which influence tape buying decisions — according to a recent survey made among tape salesmen.

PANTHER AND DRAGON FRICTION AND RUBBER TAPES ARE STRONG ON THESE PERFORMANCE FACTORS!

PANTHER and **DRAGON** Friction Tapes adhere firmly, and easily meet **ASTM** adhesion requirements. **PANTHER** and **DRAGON** Rubber Tapes fuse readily and securely and have excellent dielectric qualities. They pass **ASTM** tests for tensile strength with a wide margin of safety. All tapes pass **Federal Emergency Specifications.**

PANTHER and **DRAGON** Tapes are nationally advertised tapes, brands made and backed by the company which has specialized for over 60 years in solving problems involving the insulation of electrical wires and cables.

For full information on these tapes — or for the address of your nearest agent — write today. 4400

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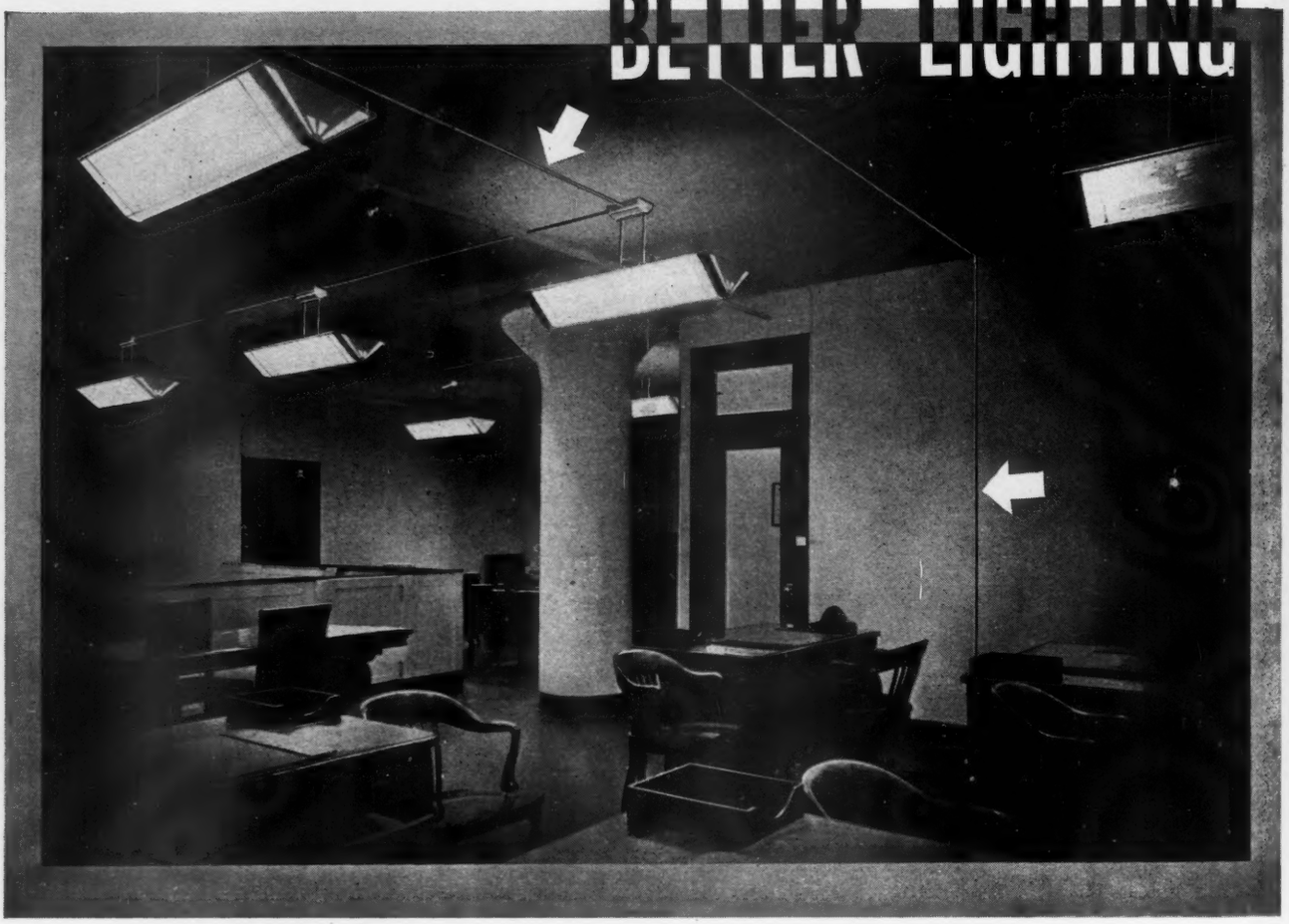
Adequate Wiring is always the first step toward

BETTER LIGHTING



It's time to again get squarely behind Adequate Wiring

Wiring for adequate electrical service that was postponed during war years...now becomes a must. Also... as every contractor and electrical inspector knows... much wiring that *was* done during war years must now be replaced.

Men who know their Wiremold know that the great majority of all such needs can now be met safely, permanently, efficiently... and at low cost by the use of WIREMOLD Raceways and Fittings. No matter what the type of building... loft or office... factory or hotel... apartment or hospital... school or home... WIREMOLD'S 10 basic INTERCONNECT-ABLE wiring systems take you all the way from panel box to outlets with least trouble and expense. Truly can we say "Know your Wiremold and you know the answers to today's wiring problems."

Write us for further information . . . for Wiring Guide and Engineering Data Sheets . . . they're free in the interests of ADEQUATE WIRING.

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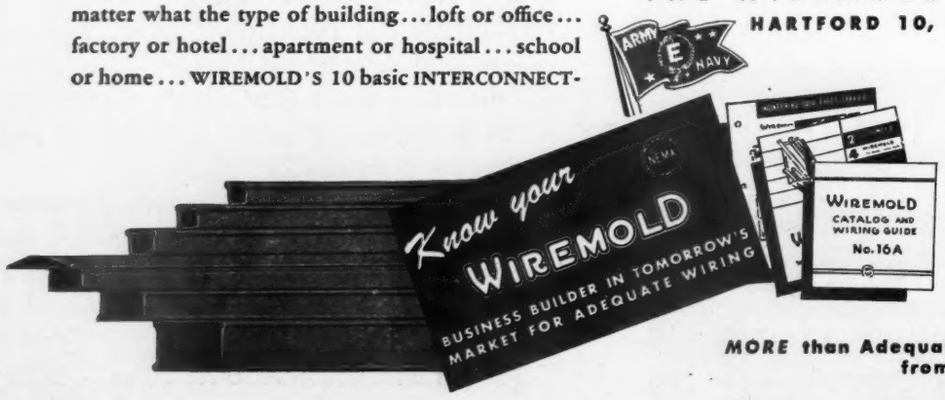
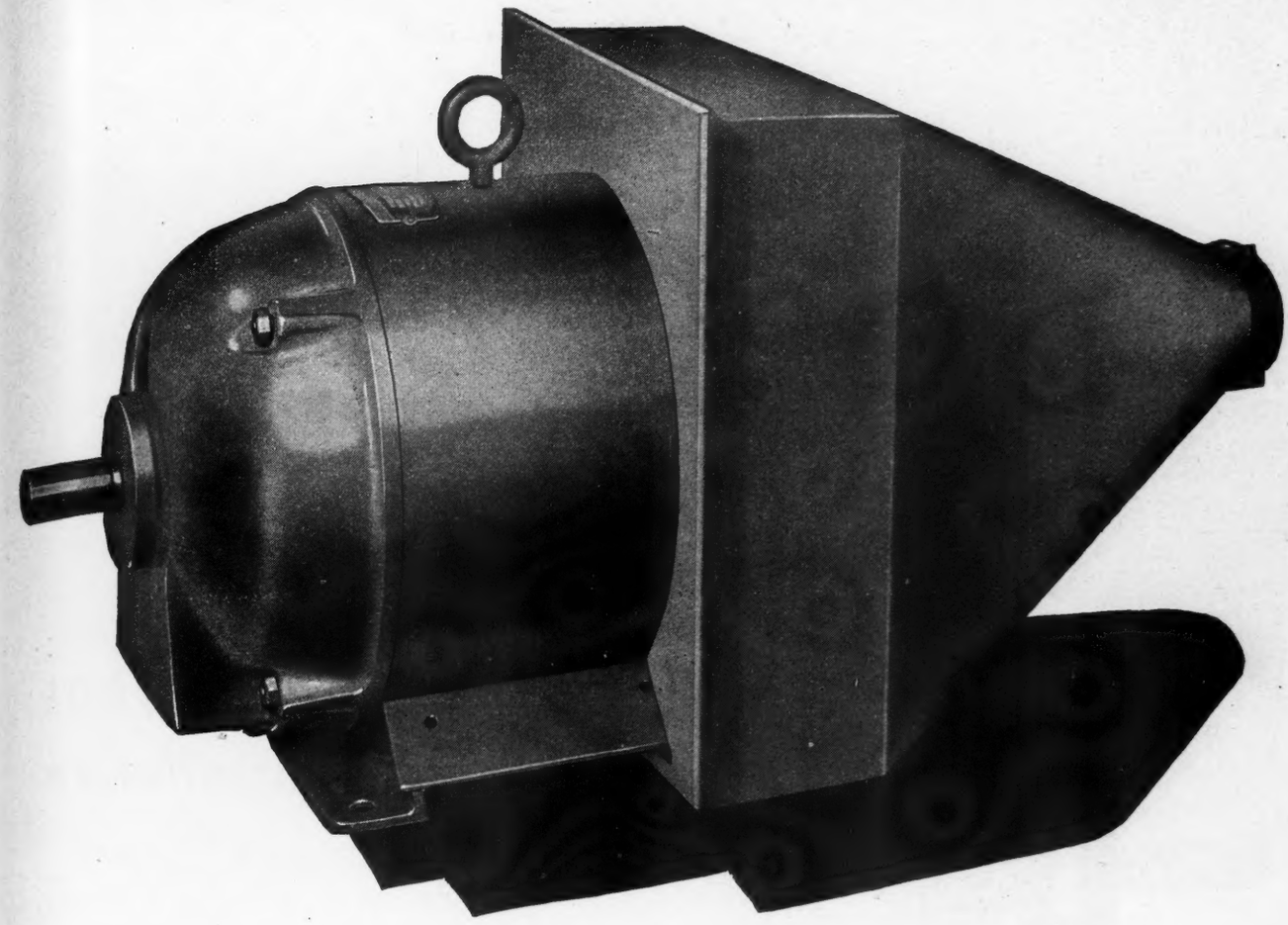


***MORE* than Adequate Wiring . . .**
from Panel Box to Outlet.

SOLD THROUGH ELECTRICAL WHOLESALERS . . . INSTALLED BY ELECTRICAL CONTRACTORS . . . EVERYWHERE!



This motor's in the "doghouse" so YOU can stay out!

Even under normal conditions, many motors must be placed close to walls or surrounded with equipment which reduces the free flow of air. With today's motor-relocation problems facing so many manufacturers, the chances of motor overheating are often multiplied.

To help you beat the heat on motors that must be mounted in close quarters, R & M engineers put all newly designed Uni-Shell Motors through the "doghouse" test. Here, the air flow produced by the fans within these motors is directed through the cone-shaped box and measured. How well the fan controls temperature rise depends on fan design, location, and the shape of motor housing openings through which the air must pass.

To evaluate these factors, to build up a background of fan efficiency, to make certain that you can't go wrong with Uni-Shell Motors for operation in high-temperature or poorly ventilated areas, is the purpose of the "doghouse" test.

If you have a motor problem (be it one of overheating or any other) let R & M engineers help you solve it.

FREE NEW BOOKLETS!

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Send for any or all of these booklets, now.

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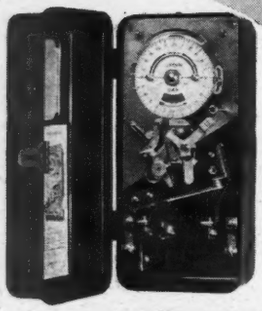
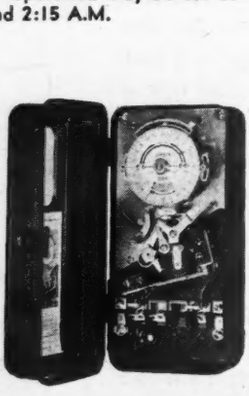


FORM KAZ—SYNCHRONOUS MOTORS SILVER CONTACTS

Six levers are provided for a maximum of 3 daily "on" and "off" operations. Accurate timing is obtained by turning the minute hand reset staff on the 24 hour dial. If desired the time-switch can be manually operated without affecting subsequent operations. Available in a wide variety of combinations providing two-circuits, duplex, and outdoor switches; also with Sunday and holiday omitting device, as well as advance time cutoff. The KAZ Astronomic Dial Time Switch functions to close the circuit at sunset and open it at sunrise, or the "off" operation may be set at any time between 9:30 P.M. and 2:15 A.M.

FORM VSWZ SYNCHRONOUS MOTOR WITH CARRYOVER

Synchronous timing is combined with reserve spring clock operation, providing continuous operation during current interruptions up to ten hours. This entirely automatic carry-over eliminates the necessity of resetting the dial after current interruptions, and insures accurate timing under all conditions. Equipped with Astronomic Dial.



ASTRONOMIC DIAL: Both of the Sangamo Time Switches shown here are equipped with Astronomic Dials. These dials enable "on" and "off" operations in accordance with sunset and sunrise.

Sell this AUTOMATIC CONTROL with every lighting installation

• Lighting—for Utility Purposes, for Advertising Displays, for Protection — has definite "on" and "off" periods.

The men who buy such installations naturally are interested in the accuracy of these "on" and "off" periods.

They want the lighting, for its intended purpose, during the hours it is most valuable and effective.

That's why SANGAMO TIME SWITCHES are so widely used — AUTOMATIC CONTROL does the exact job of turning the lighting on at a specified time and off at the exact second at which the SANGAMO TIME SWITCH is set. There is nothing left to chance.

Sell SANGAMO TIME SWITCHES with each lighting installation — they give you added profit and insure greater consideration for your work by the customers.

See our catalog for complete details — write for your copy now.

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YOU'LL *Get it Together...* FASTER!

with

Thor PORTABLE ELECTRIC SCREW DRIVERS and NUT SETTERS

An accurate, adjustable clutch on this Thor Model ULTW electric screw driver provides positive tension control to set screws to exact tightness.

You can drive screws and nuts at top speed, confident that they will be driven to exact and uniform tightness with complete safety to men, material and fastener when you use Thor Universal Electric Screwdrivers and Nut Setters. With Thor's *complete line* of power units and attachments you can be sure of tools with precisely the right speed, power and control to do your assembly jobs better and quicker.

Whatever the size, type, position or tension requirements of your screw driving and nut setting operations—call today on your nearby Thor electric tool distributor. *Thor engineers serving him—and you—have never failed to solve any such assembly problem yet presented!* They'll be glad to check on *yours* . . . without obligation.

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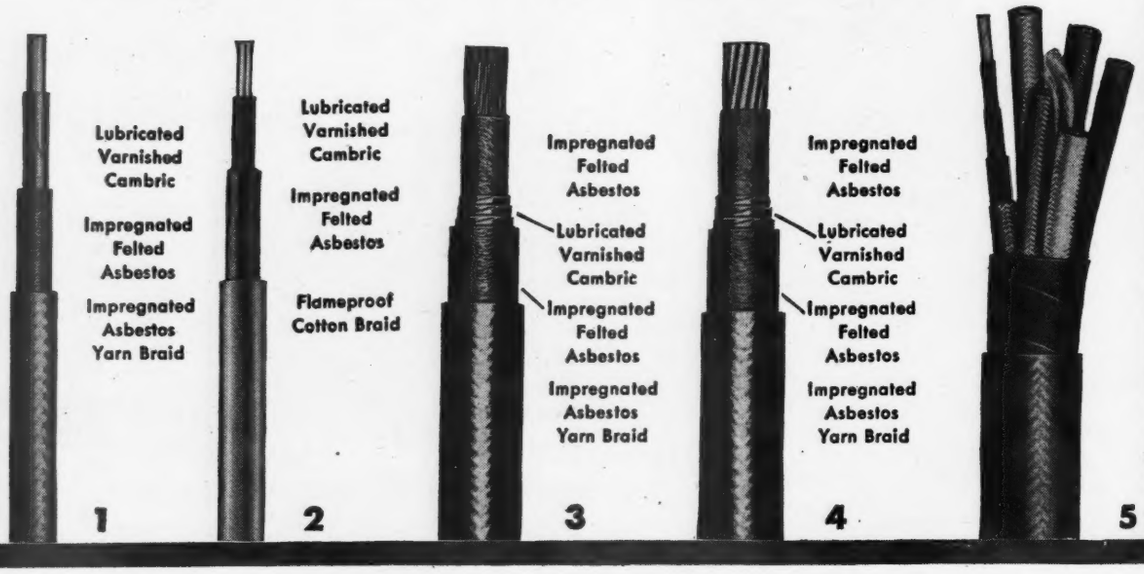
5-POINT PROGRAM

for Eliminating Wire-Failures
in Control, Power and Lighting Circuits
exposed to Severe Operating Conditions



1. **National Electrical Code Type AVA** (max. operating temperature 230° F.) Rockbestos A.V.C. 600 Volt Boiler Room Wire in sizes No. 18 to 4/0 AWG. For lighting and control circuits around boilers, furnaces, steel mills, etc., and resistor wiring.
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3. **National Electrical Code Type AVA** (max. operating temperature 230° F.) Rockbestos A.V.C. 600 Volt Flexible Motor Lead Cable in sizes No. 18 AWG to 1,000,000 CM. For coil connections, motor and transformer leads exposed to heat and moisture, oil, grease and fire hazard.
4. **National Electrical Code Type AVA** (max. operating temperature 230° F.) Rockbestos A.V.C. 600 Volt Power Cable in sizes No. 18 AWG to 2,000,000 CM. For power circuits and hot-spot wiring in generating and industrial plants.
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For new installations and maintenance jobs where circuits are exposed to high ambients, or heating and cooling cycles, install failure-prevention and greater current carrying capacity with Rockbestos A.V.C.

These National Electrical Code type *permanently insulated* Rockbestos developed wires are insulated with the time-tested combination of lubricated varnished cambric and *impregnated felted asbestos* that stands up under high ambient temperatures and conductor-heating overloads without baking brittle or flowing . . . without cracking under vibration . . . without rotting or swelling in contact with oil, grease or fumes . . . and without burning when exposed to flame.

Rockbestos A.V.C. has ample moisture resistance for conduit installations — and for dry high-temperature applications there are many other *permanently insulated* Rockbestos All-Asbestos (N. E. Code Types) wires, cables and cords in our line of 125 different standard constructions. Specify them for long and dependable service under severe conditions in boiler rooms, steel mills, steam tunnels, power plants . . . and around furnaces, kilns, lehrs, steam lines, ovens or other hot spots.

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The Wire with Permanent Insulation

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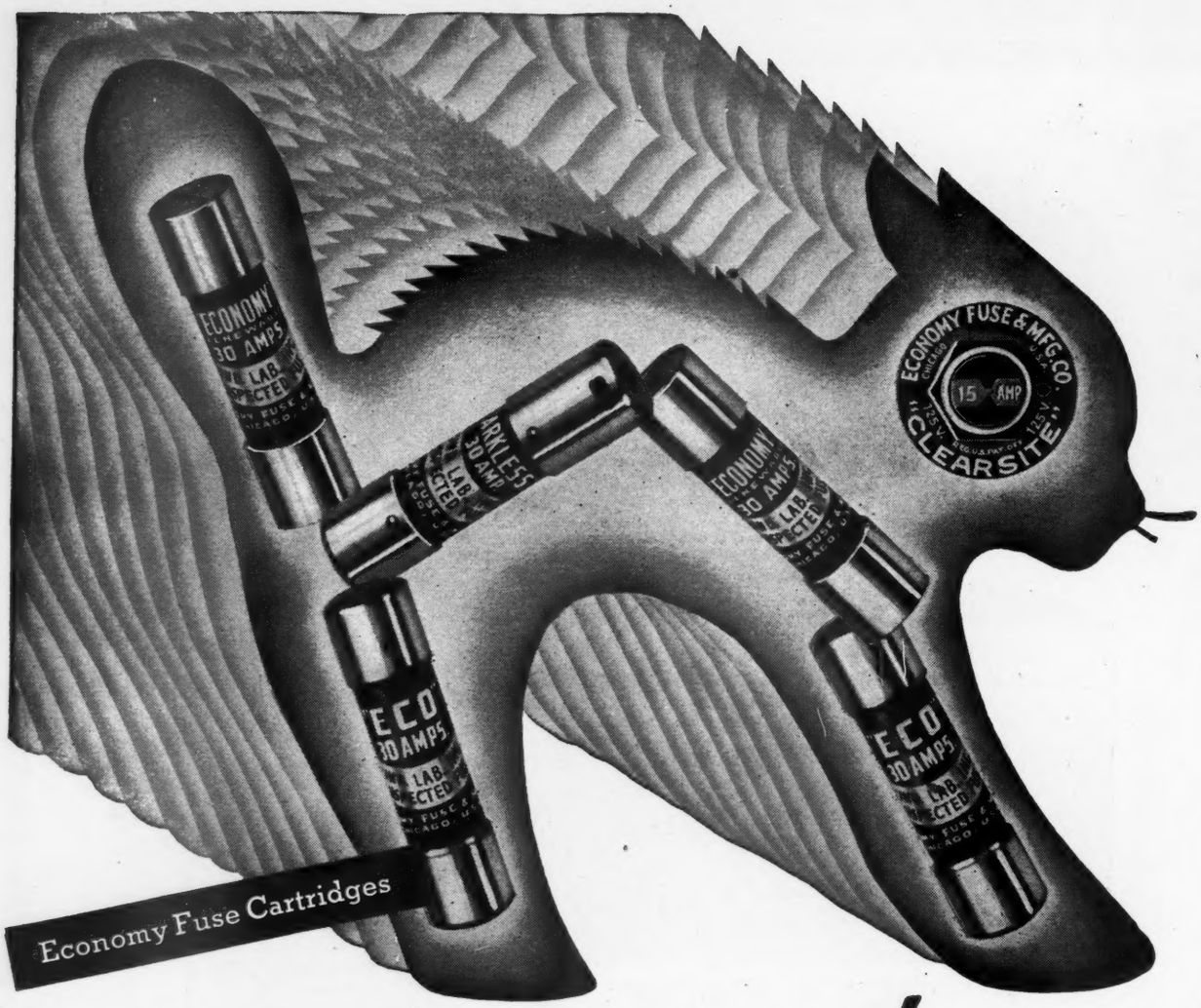

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Over and *over* and *over* again you can use Economy Fuses with Economy "Drop Out" Renewal Links.

Each Economy Cartridge Fuse is designed to last indefinitely... a tough molded body of high grade vulcanized fibre tubing, with extra heavy brass inserts and caps, accurately machined... built to give service and prevent needless and costly current interruptions.

Economy "Drop Out" Renewal Links are inexpensive... give *full limit* protection... are easily and quickly replaced to restore a blown fuse to its original efficiency.

Economy pioneered and developed the use of renewable fuses. It has constantly improved the quality, performance and dependability of Economy Fuses and "Drop Out" Renewal Links.

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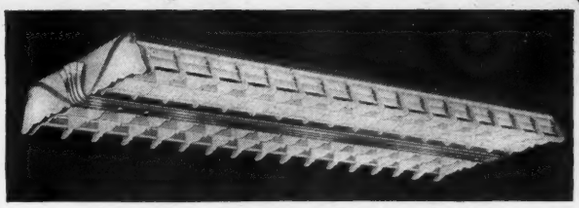
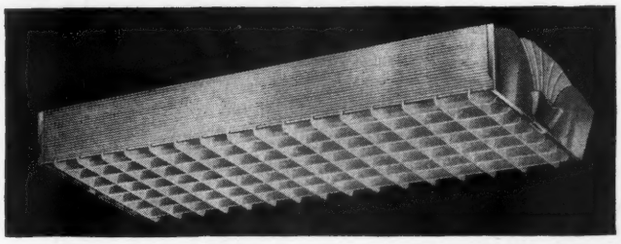
THE BEAUTY LINE

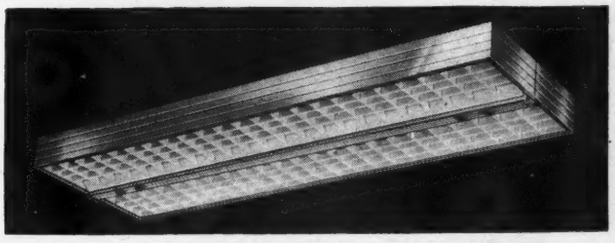


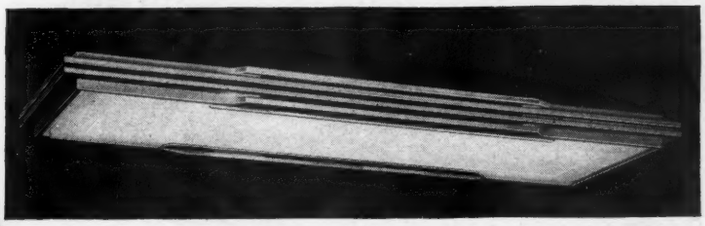
DAWN—This beautiful fixture brings definite charm and decorative effect to an interior — provides distinctive, highly efficient lighting. Graceful louvers are scientifically designed to give better lamp shielding. V type reflectors give 80% down lighting with soft glow on ceiling.



SKYLITE—A new high in efficiency combined with beauty. Decorative, illuminated end caps, diffusing side glass shields and graceful louvers make this SKYLITE outstanding. Parabolic reflectors and frameless, shallow louvers provide even brightness over face of unit.

LOUVERLITE—Its slim, graceful lines enhance the beauty of any modern interior. Parabolic reflectors and shallow louvers with many openings give an effect of a smoothly diffused sheet of light. Three inch overall depth permits close ceiling mounting. Frame and louver, built as a unit, swings down easily, exposing wiring and ballasts.





HORIZON—Smart — graceful. Frame of light, natural wood lacquered and waxed. May be had with etched glass panel or steel louver. Overall depth three inches.

Distributed exclusively through electrical wholesalers

OTHER DESIGNS are shown in our catalog

"SMART STYLING IN COMMERCIAL FIXTURES"

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It's the TOP Fluorescent Fixture Line

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TOUGH TREATMENT is easy going for rugged Roebling portable cables. Drag or tangle them, immerse or run over them . . . they keep giving *full* service.

They're tough themselves—built to flex easily yet withstand hard knocks . . . on shovels, mining machines, welding equipment, power drills, other portable machinery.

Roebling "extras" in cable manufacture—like lead-mold curing to assure a slick, tough rubber jacket—pay off for the cable user. Whatever the purpose, Roebling has the right electrical wire or cable for it.

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ELECTRICAL WIRES AND CABLES

HEAT RESISTANT!

SAFE!

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ROEBLING RUBBER PORTABLE CABLES

Roeclad for high abrasion and impact resistance, and Roecable for extra flexibility, both supplied with or without ground wires.

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Twin Flat Type with parallel conductors. Also Single Conductor Type specially suitable for mine locomotive reels.

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Roeweld Type TRPH for lead or trailing cables, recommended for use where dampness or abrasion prevails.

ROEBLING RUBBER JACKETED FLEXIBLE CORDS

Made in a variety of types for pendants and light or heavy portable use in homes, offices and shops, to resist normal conditions or exposure to oils, acids and sunlight.

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Weatherproof Wire • Service Entrance Cables • Rubber-Covered Wires and Cables (Including Thin-Wall Insulated Building Wires and Cables) Rubber Sheathed Portable Cables • Rubber Insulated Power Cables • Magnet Wire Telephone Wires • Pigtail and Braided Copper • Trolley Contact Wire • Bare Copper Strand Varnished Cambric Power Cables

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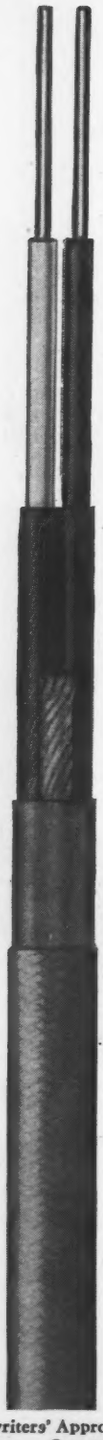

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REGISTERED TRADE MARK

With Thermo-plastic Insulated conductors

FEATURES

1. Small overall diameter—Easy to handle. Requires smaller holes
2. Lighter weight—Facilitates handling during installation
3. Type T conductors—Insulated with long-life thermo-plastic compound
4. Small diameter of conductors—Requires less space in outlet boxes
5. Positive conductor identification—Insulation has permanent color
6. Conductor insulation—Resistant to oils, acids and alkalies
7. Insulation and braid—Both are flame- and moisture-resistant
8. Improved braid finish—Smooth, non-tacking and non-marking
9. Free stripping—Braid, paper armor and insulation all free stripping
10. High rating—Approved for 60 degree C operation

You'll like high quality PVX cable. Its small diameter and light weight make it easy to install. Its Type T conductors are insulated with thermo-plastic compound which is resistant to oils, acids, and alkalies. These conductors are protected with an improved crushed paper armor and covered with a tough moisture-resistant overall braid. The whole assembly can be freely stripped. PVX is recommended for open and concealed work in homes, farm buildings, etc., where permitted by local codes and the National Electrical Code.

OTHER G-E BUILDING WIRES AND CABLES

In addition to PVX there are many other wires and cables in the G-E line—wires and cables for every purpose. G-E building wires include Types T, TW, R, RH and RW in sizes No. 14 to 2,000,000 CM. G-E cables include BX armored cable, BraidX non-metallic sheathed cable and service entrance cable Type SE in all wanted sizes. These wires and cables are carefully made, uniform and have high quality.

For further information on the new PVX cable or on other G-E wires and cables see the nearest G-E Merchandise Distributor or write to Section W261-8, Appliance and Merchandise Department, General Electric Co., Bridgeport, Conn.

GENERAL ELECTRIC

WHY- Standard TRADE MARK DRY TYPE TRANSFORMERS

Save Money and Manhours FOR YOU

★ Installed at POWER LOAD CENTERS

Dry Type, air cooled transformers, combined with protective equipment, result in economy and efficiency for indoor distribution systems. Specialization in transformer design coupled with 25 years' experience make STANDARD a dependable source for consultation as well as transformer production. Here's how you'll benefit by specifying STANDARD dry type load center units:

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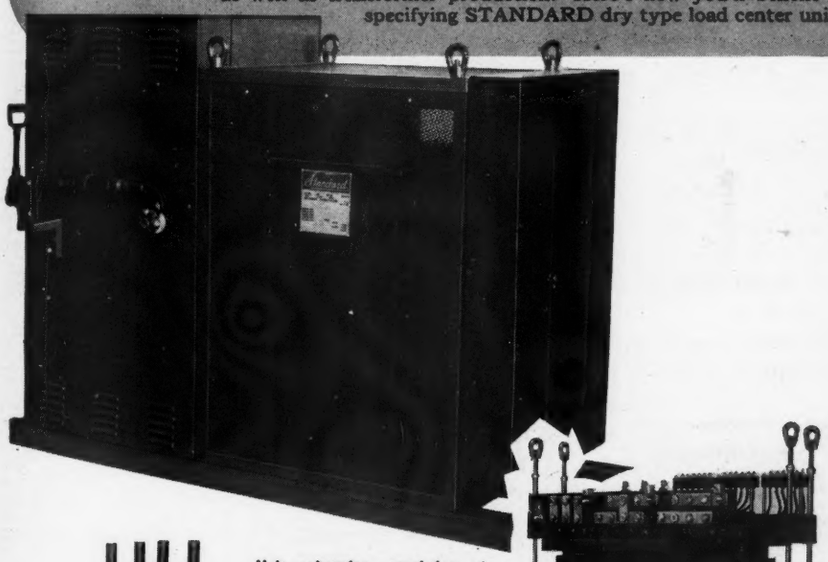
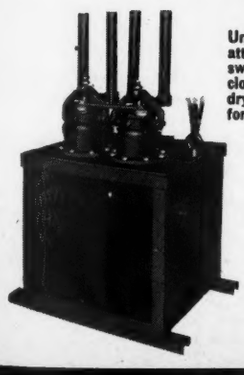
2. save LABOR . . . order transformers with switches, breakers or fuses combined in one unit.
3. save SPACE . . . easily installed above the floor or in out-of-the-way locations to conserve floor space. No fireproof vaults needed.
4. save ON MAINTENANCE . . . no liquids to test or filter on dry type transformers.
5. save ON FIRST COST . . . since no extra engineering and less labor costs are involved in fabricating unit substations.
6. increase EFFICIENCY of motors by supplying full voltage.
7. increase EFFICIENCY of lighting — eliminate flicker and get full illumination by supplying full voltage.
8. increase TRANSFORMER CAPACITY through use of Class B insulation (fiberglas and similar inorganic materials) which permits greater intermittent overload capacity.
9. increase FLEXIBILITY of system, since transformer and attached equipment may be easily relocated when necessitated by changes or moves in production equipment.

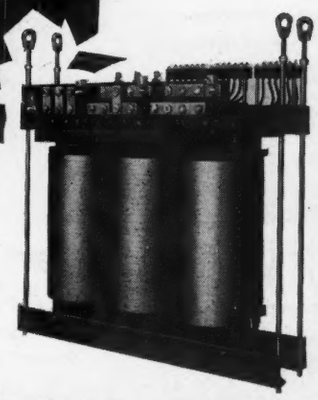
Standard Engineered and built Dry Type Power Load Centers provide all of the above plus permitting the user choice of make, type, and arrangement of accessory equipment.



Unit substation, consisting of attached high voltage disconnect switch and fuses, low voltage enclosed circuit breaker panel and dry type air cooled 600 KVA transformer. H-beam base construction permits portability. Suitable for platform mounting in large industrial building.



Twenty-five KVA, single phase, 2400 volt air cooled unit with attached oil fuse disconnects, arranged for platform mounting.



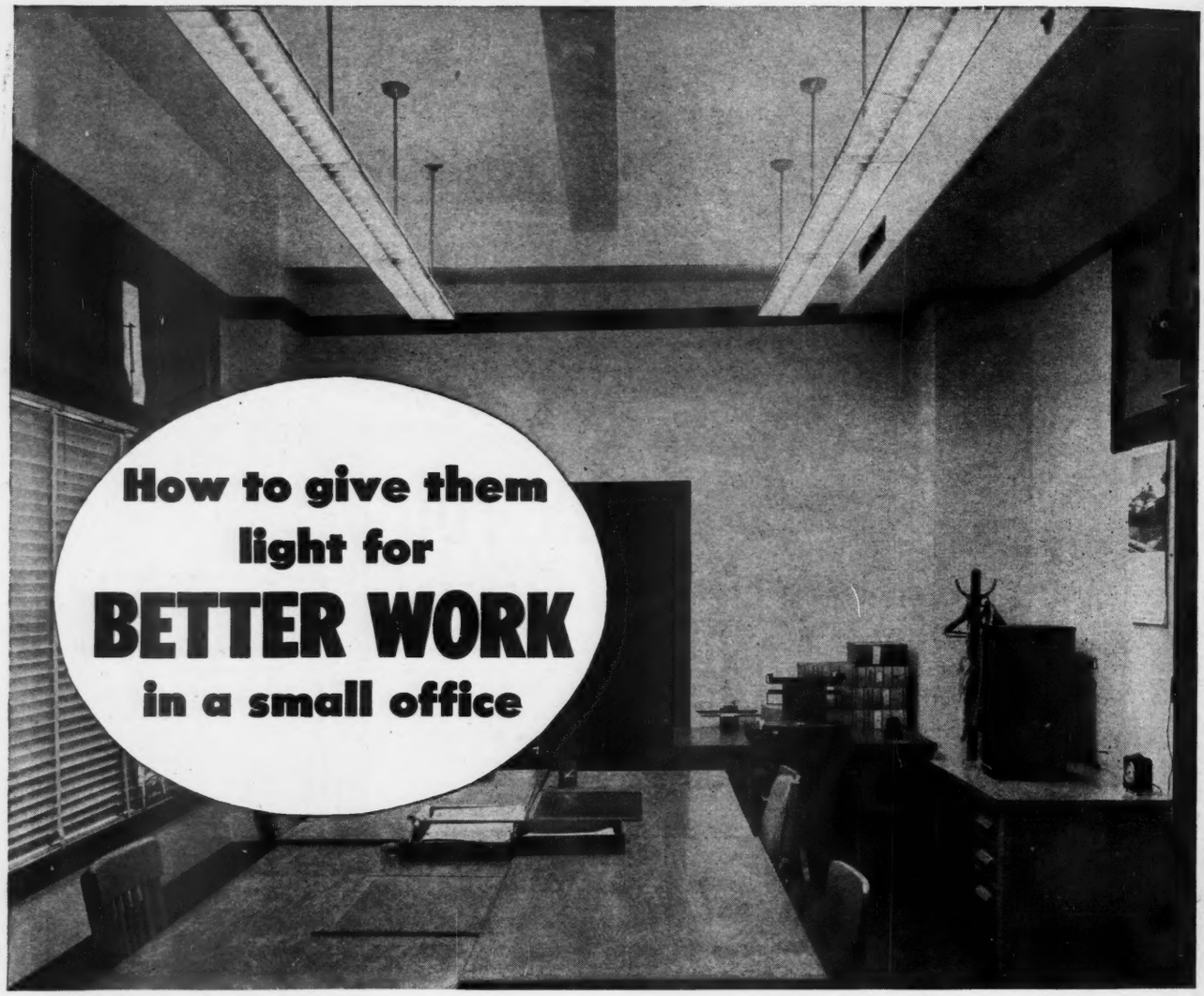
Core and coil structure of this class B insulated (for 80°C temperature rise) transformer. STANDARD makes full use of the newest in transformer insulating materials.

FOR EVERY CLASS OF Service

THE STANDARD TRANSFORMER CO.

WARREN, OHIO

THE SPECIALISTS IN TRANSFORMER DESIGN FOR OVER 25 YEARS



Wanted: Light for better work in a small office . . . in this case a stenographic section.

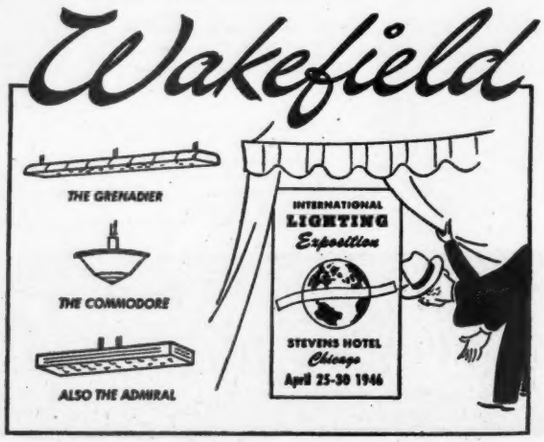
Problem: To provide good distribution of high level lighting in a narrow office, and to provide it as pleasingly and unobtrusively as possible, for greater eye comfort and minimum eyestrain.

Solution: Continuous rows of Wakefield GRENADIERS (No. PG-2488) to supply plenty of soft light on desktops and typewriters and diffused overall light throughout the room for easy, comfortable seeing. (In a small office, particularly, high footcandles of direct light tend to create bright spots and harsh contrasts—tough working conditions.)

In this 15′ x 22′ room, ten units were used, in rows 8′ apart. Mounting height 11′, with a 14′ ceiling. And since GRENADIERS can serve as their own carrier of conduit, existing outlets handled the job without re-wiring. Lighting level, after four months' service: 45 footcandles that make for fewer errors and headaches.

Your customers' offices may present different problems, call for different fixtures. But you can be sure of this: Wakefield will be glad to work with you . . . to help you supply lighting that will fit their needs. The F. W. Wakefield Brass Company, Vermilion, Ohio.

Are your customers throwing away DOLLARS? *Proper lighting maintenance—cleaning fixtures and walls and relamping—can double or triple their light! Urge them to get the lighting value they pay for—keep lighting fixtures clean!*

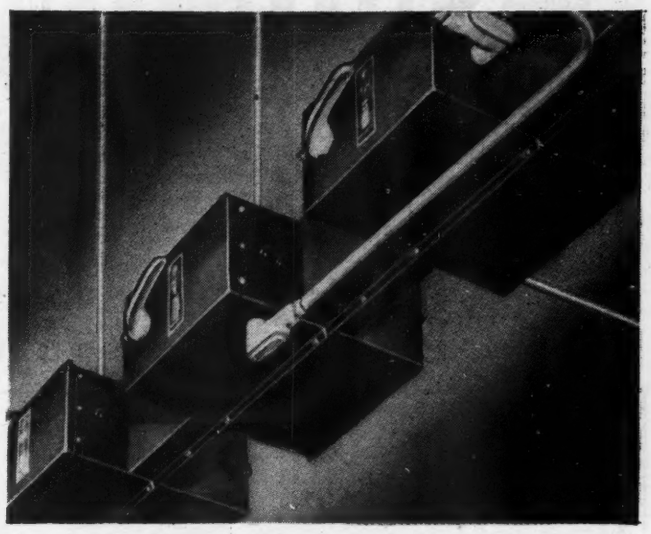


THE BIG 3 OF ELECTRICAL DISTRIBUTION

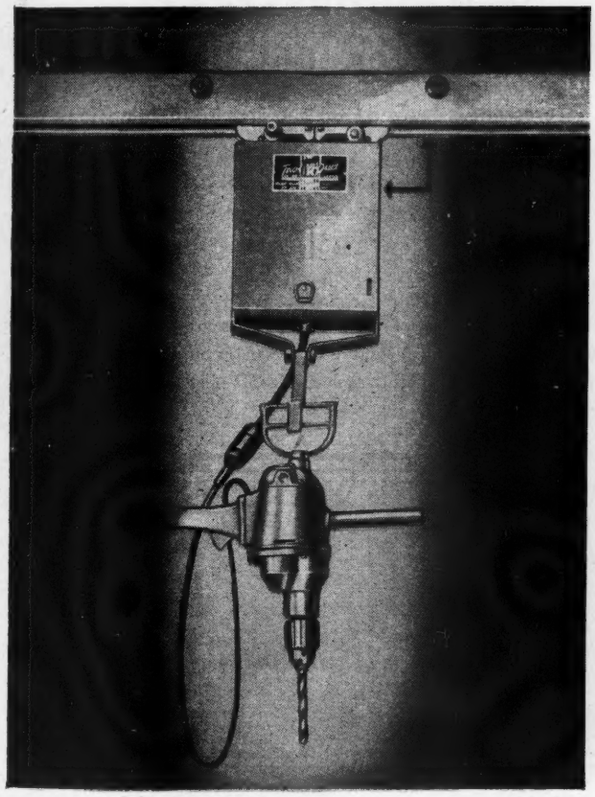
Meet the "Big 3" of electrical distribution: BullDog BUStribution DUCT, Industrial Trol-E-Duct and Universal Trol-E-Duct!

Recognized by industry as the most efficient systems of their type, these pioneers in the field of completely flexible and salvable electrical distribution systems are today saving countless hours on installation and maintenance — greatly reducing changeover time — helping to bring peacetime production to top speed and efficiency.

If you hope to successfully compete in the peacetime battle of costs ahead, it will pay you to investigate these superior BullDog Electrical Distribution Systems. Write now for complete details.



1 FOR PLUG-IN POWER, BullDog BUStribution DUCT which includes a variety of circuit protective tap-off Bus Plugs enables you to spot and plug-in plant machinery almost as readily as you plug-in your vacuum cleaner at home. No lost motion—no lost time! RATINGS: Plug-in Type up to 1350 Amps. Feeder Type up to 4000 Amps. 575 Volts or less.



2 FOR PORTABLE TOOLS, Cranes, Hoists or similar moving "loads" BullDog Industrial Trol-E-Duct supplies a source of safe, mobile power by means of Trolleys which, as they move through the elongated slot in duct, transmit current from the duct bus bars to the moving load. RATING: 90 Amps. 575 Volts or less.

3 FOR COMPLETELY FLEXIBLE LIGHTING, Universal Trol-E-Duct is a busway wiring system that can be tapped with Plugs or Trolleys at any point through the continuous slot in duct casing . . . Always keeps your lighting modern, for changes in type of fixture can be as readily made as changes in lighting positions. RATING: 50 Amps. 250 Volts or less.

BULLDOG

ELECTRIC PRODUCTS COMPANY

DETROIT 32, MICHIGAN.
In Canada:
BullDog Electric Products of
Canada, Ltd., Toronto.
Field Offices in All Principal Cities

Manufacturers of
Vacu-Break Safety Switches — SafToFuse Panelboards — Switchboards — Circuit Master Breakers — BUStribution Duct, for "plug-in" power — Industrial Trol-E-Duct for moving "loads."

Guth FLUORESCENT

KEYED FOR THE SPECIFIC LIGHTING JOB!

Proofs of GUTH "Know-How" Lighting in the Transportation Industry

Original fixture design by ELEC. DEPT. of B. & O.R.R.— final design by Edwin F. Guth Co.

Guth FLUORESCENT Perfect Reading Light

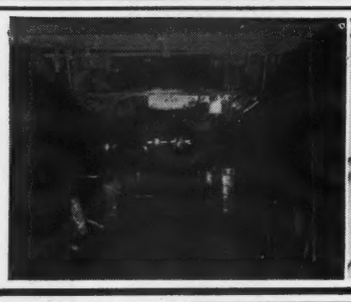
GUTH Fluorescent is "keyed" for the specific lighting job. To the left, for example, is the Waiting Room of the Washington, D. C. Union Terminal. Here, with GUTH Fluorescent, a person can wait and read in comfort, as there is no glare —just pleasant, shadowless "seeing light" directed over his shoulder onto his newspaper or magazine.

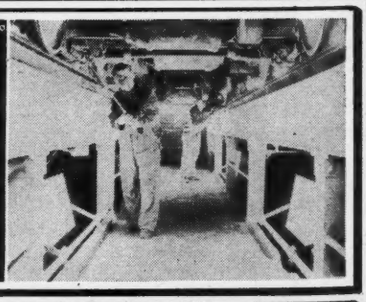
SOLUTION: GUTH Fluorescent is mounted continuously atop settees. Single forty-watt lamps, continuous, are used; fixtures are well-louvred to cut off all glare from facing seats. Eighteen foot-candles were measured on the reading plane.

Guth FLUORESCENT Inspection Lighting

Every business has lighting problems peculiar to itself, Inspection Pits in the Transportation Industry, for example. Here, as elsewhere, GUTH Fluorescent provides the efficient solution. Ruggedly constructed to withstand long, hard usage. The "Before-and-After" photos at the right clearly show the improved seeing and working conditions resulting from "keyed" GUTH Fluorescent.

GUTH FLUOFLECTORS deliver 50 foot-candles at the working area. QUICKLITER ballasts supplied with these GUTH Units give reliable operation even at winter temperatures. Lamps are enclosed; protected against dirt and grease.





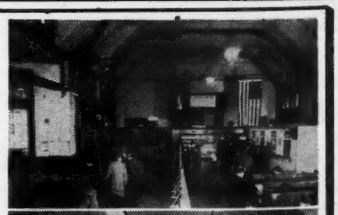
Guth FLUORESCENT Office Lighting

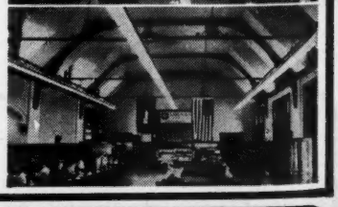
This large railroad office uses GUTH Fluorescent to produce 60 foot-candles of comfortable, proper lighting on desks and working areas. In addition, the planned design of GUTH Fluorescent affords low maintenance costs.

Guth FLUORESCENT General Lighting

At right are "Before-and-After" lighting photos of the Portland, Maine Union Station. A completely new atmosphere has been created with GUTH Fluorescent.

GUTH FUTURLITERS on 12' 0" spacing and 12' 0" mounting, provide 40 foot-candles on ticket counters, and 30 foot-candles through balance of area.





2615 WASHINGTON AVE. **THE EDWIN F. GUTH CO.** ST. LOUIS 3, MISSOURI

LEADERS IN LIGHTING SINCE 1902

PRISONER OF THE PAST

...until ADEQUATE WIRING Frees it!

An industrial building may look enough . . . may *be* big enough to take care of tomorrow's suddenly stepped-up demands for greater output. Yet, if it isn't "big enough" electrically . . . hasn't the Adequate Wiring for full electrical efficiency, it is shackled to the past, held down to an outworn, outdated production quota.

Adequate Wiring, however, is more than a reservoir for future needs. It means not only conductors of ample size — but enough circuits and the kind of electrical system that can supply all the needs of power and lighting (both present and future) *at the lowest cost per kilowatt used.*

In existing factories, office buildings and other industrial structures, this lower power cost may take various forms. It may appear in reduced voltage drop when skimpy wire sizes are replaced. It may show substantial economies when high voltage cables are used and when unit sub-stations are erected at load centers. It may result in savings through power factor correction when full advantage is taken of synchronous motors and capacitors.

And in new buildings, only Adequate Wiring can forestall the need for wasteful, work-delaying dismantling operations in the future. In planning Adequate Wiring and in applying its benefits to buildings now in use or soon to be erected, let an engineer work with you — an engineer of The Okonite Company, Passaic, N. J. or The Hazard Insulated Wire Works Division, Wilkes-Barre, Pa.

HAZARD

insulated wires and cables for adequate wiring at its best

4355

ILLINOIS
PORCELAIN WIREHOLDER
INSULATORS

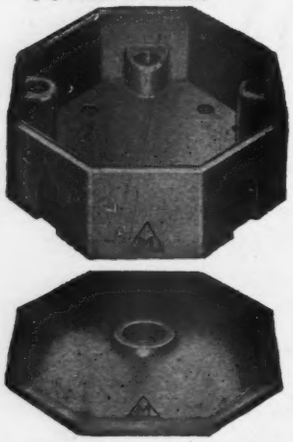
Insure
SAFE HOUSE SERVICE CONNECTIONS..

• When you use Wireholder Insulators with the name "ILLINOIS" you are backing up your work with the right quality for the job.

All corners are rounded to prevent injury to the insulation of the wires. The screws have deep, sharp threads for easy installation. The screws are fastened into the insulators with non-shrinking metal alloy. The all-steel screws are hot galvanized by a special process to insure a smooth, even coating. Will not cause rust streaks on the sides of buildings. These dry process wireholders are made in sufficient styles and sizes to meet all requirements. Wet process porcelain supplied on special order.

ALL-PORCELAIN ILLINOIS SYSTEMS *for outstanding, adequate and modern wiring jobs*

OUTLET BOXES



Glazed and unglazed styles conforming to all existing standards of dimensions, spacing, position of knockout holes, and mounting screws. High mechanical and electrical efficiency.

SWITCH BOXES

Insure greater safety in wiring and the elimination of all grounding hazards. Made of the best quality of white porcelain. Metal inserts are placed in two holes of the switch boxes for receiving screws of standard switches, plug outlets, etc. Knockouts for single wires, also for cables. Specify and use them.

Bull Dog

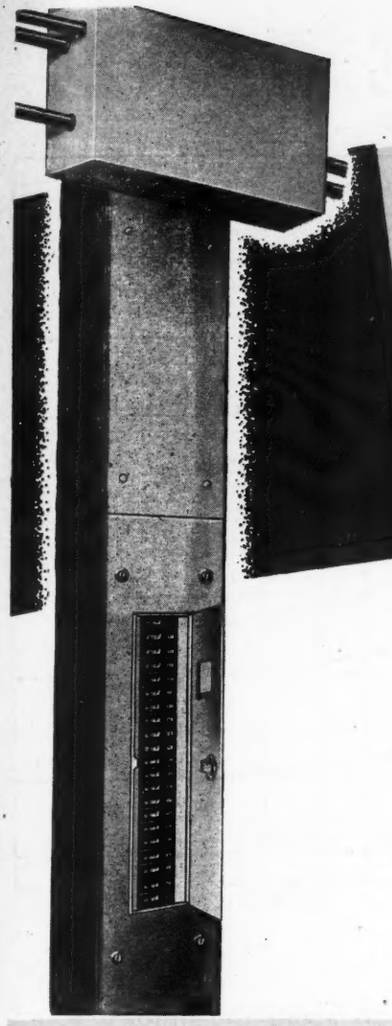
KNOBS

Cement coated — extra length nail—genuine leather washer — code standard. They don't chip when driven in and they do stay in place and have a firm grip. Available in a wide variety of heights, diameters, holes, and grooves.

STANDARD TUBES

In sizes ½ to 48 inches, 5/16 to 3 inches diameter in following types: unglazed, glazed, split, floor, split floor, headless, curved end, crossover split, and cross over. Diameters all uniform both inside and outside.

ILLINOIS ELECTRIC PORCELAIN COMPANY *Macomb, Illinois*



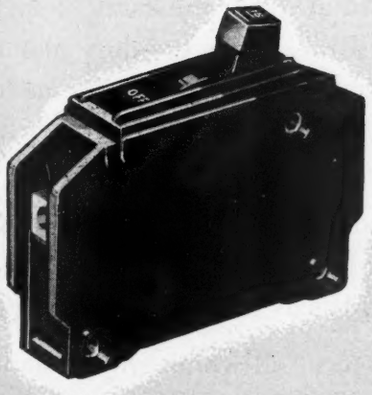
WHEN SPACE IS LIMITED

You'll get full capacity and safety with

WURDACK COLUMN TYPE CIRCUIT BREAKER PANELS

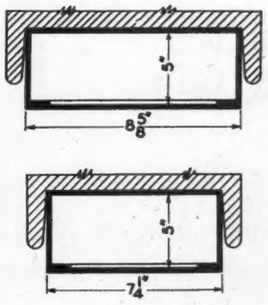
Wurdack Column Type Panelboards are primarily designed for compactly mounting in the recesses between the flanges of "H" columns conveniently located in industrial plants. Designed for compactness and space saving they can also be used for other applications where limited space will not permit the conventional size of cabinet.

Where modern industrial plants require lighting appliance controls among their production assemblies, the Wurdack Column Type Circuit Breaker Panelboard is unsurpassed for compactness in design, safety and for assurance of uninterrupted power service. Their great flexibility and adaptability make them an expedient "must" in your plans for plant expansion and reconversion.



WURDACK "QUICKLAG" BREAKERS

Wurdack Column Type Circuit Breaker Panelboard can be supplied with Wurdack "Quicklag" Circuit Breakers which give instanteous trip action on short circuits and inverse time limit on overloads plus arc quenching by means of the deionizing principle.



Cross section views illustrate the compactness and utility of standard Wurdack Column Type Panelboards.

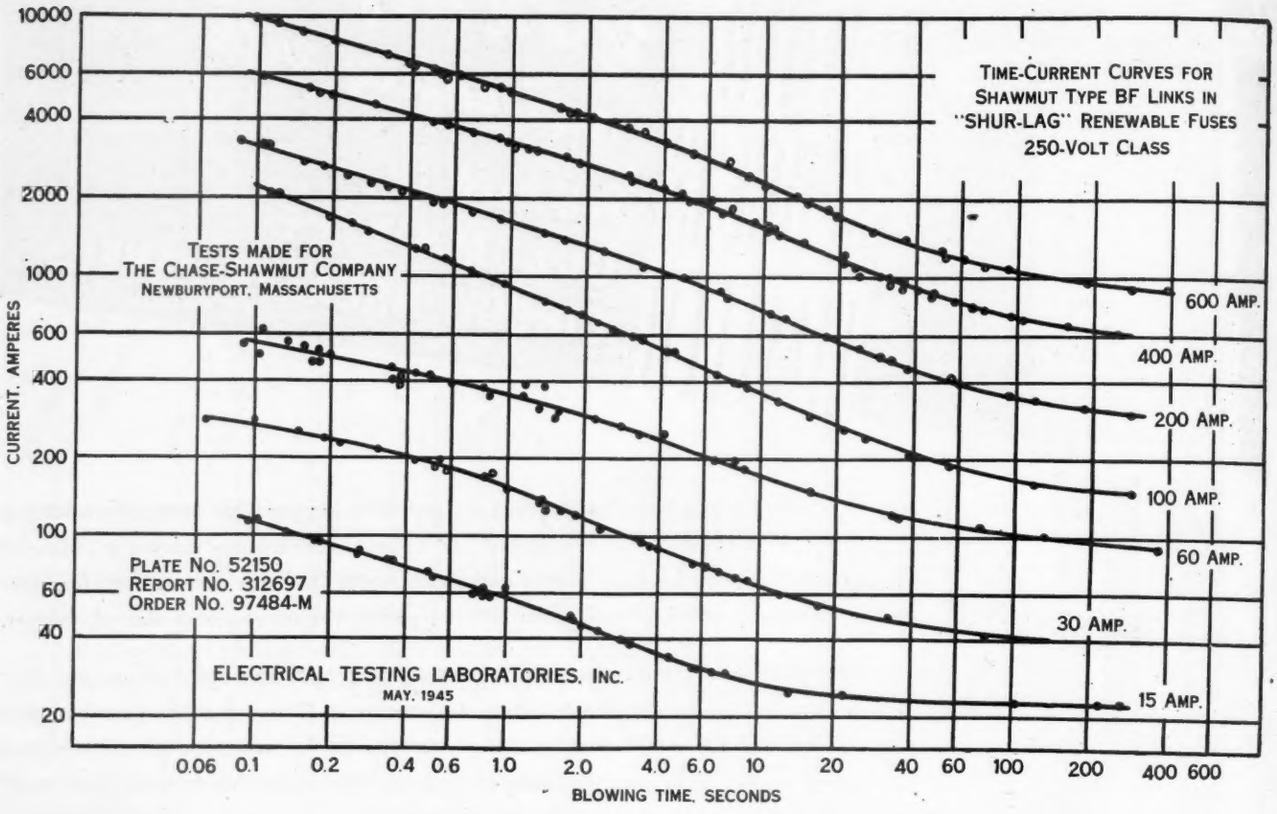
The conventional Wurdack Column Type Panel installation consists of circuit breaker panel, combination cabinet and trough extension with junction box mounting neutral, located adjacent to top of cable duct. Other variations can be made such as installing panel and cabinet in recess on column and using conduit for extending main and branch circuit feeds from pull box down to panel.

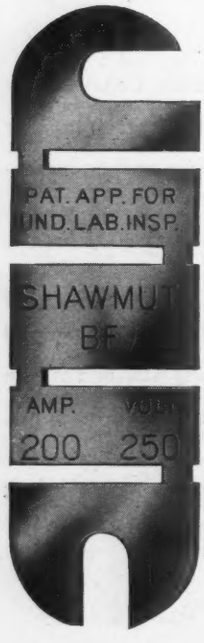
Reserve your copy *now* of the new Wurdack Circuit Breaker Catalog.

WM. WURDACK ELECTRIC MFG. CO.

4444 CLAYTON AVENUE — SAINT LOUIS 10, MO.

LAY IT ON THE LINE





There have been many vague claims about the time-current values of long time-lag fuses. But Shawmut gives you facts — and here are the facts about the Shawmut BF Link, for heavy-duty motor starting and running. These curves represent time-current tests made and plotted by the Electrical Testing Laboratories of New York. They are actual values, shown clearly and completely.

For a real comparison in performance, lay any other fuse link time-current data on these actual, certified curves of the Shawmut BF Link. No other link, so far as we know, has as long a safe time-lag.

The B in BF means that this link meets all commercial standards; the F, that it meets all Federal specifications; and the BF that it's the Best Fuse Link for all-around use.

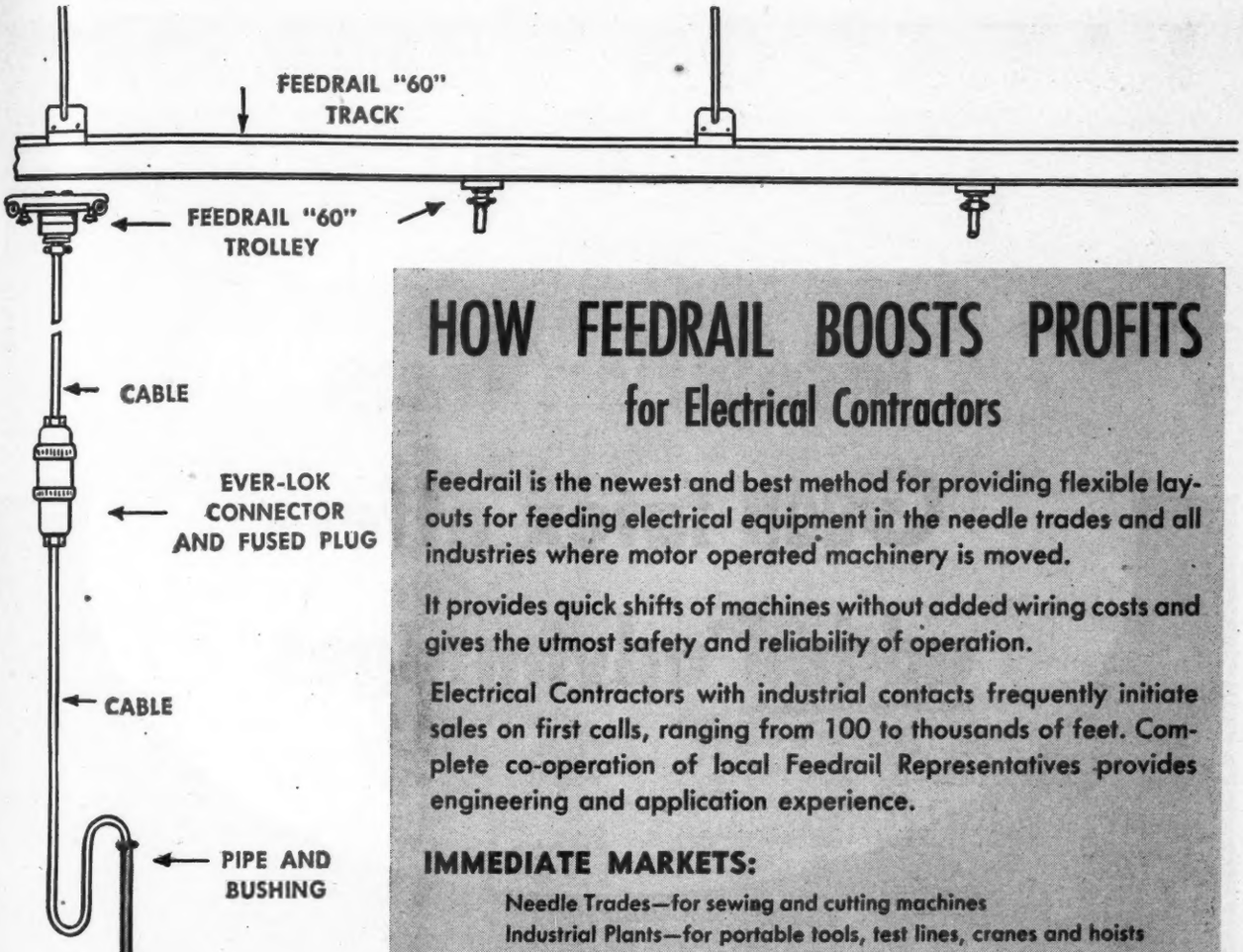
Ask our representative, or write to us for a sample link and full particulars.

THE CHASE-SHAWMUT COMPANY, NEWBURYPORT, MASSACHUSETTS

Boston, New York, Syracuse, Philadelphia, Baltimore, Atlanta, Detroit, Columbus, New Orleans, Indianapolis

FUSE MAKERS SINCE 1893

Chicago, St. Louis, Dallas, Omaha, Kansas City, Denver, Los Angeles, San Francisco, Seattle, Minneapolis



HOW FEEDRAIL BOOSTS PROFITS

for Electrical Contractors

Feedrail is the newest and best method for providing flexible lay-outs for feeding electrical equipment in the needle trades and all industries where motor operated machinery is moved.

It provides quick shifts of machines without added wiring costs and gives the utmost safety and reliability of operation.

Electrical Contractors with industrial contacts frequently initiate sales on first calls, ranging from 100 to thousands of feet. Complete co-operation of local Feedrail Representatives provides engineering and application experience.

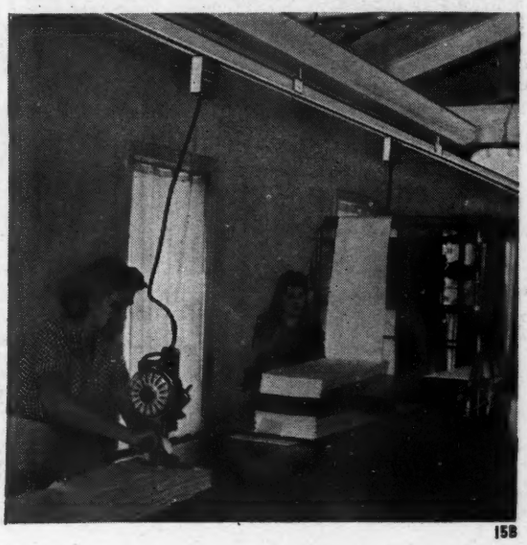
IMMEDIATE MARKETS:

Needle Trades—for sewing and cutting machines
Industrial Plants—for portable tools, test lines, cranes and hoists

The following catalogs are available: General No. 15, Needle Trades No. 16, Machine Tools No. 17

FEEDRAIL CORPORATION
Subsidiary of Russell & Stoll Co., 125 BARCLAY STREET, NEW YORK 7, N. Y.

FEEDRAIL *is handy for cutting machines—particularly over long tables. The trolley moves along with the machine. Note the moving cloth laying machine with inspection light on* **FEEDRAIL**



15B

Insulation from
Geon latex offers
added advantages
In radio hookup
and switchboard wire.
In impregnated glass
insulating tapes.
In semi-conducting
coatings.

Along with all the advantages Geon *has in domestic, industrial, and utility wiring*

THE properties of extruded wire and cable insulation made from GEON are well known in the electrical field—excellent electrical properties, resistance to most normally destructive elements, ease of handling, and many others.

All these advantages—*plus important additional ones for particular applications*—can be had through the use of GEON latex which coats wire and tape by a dipping process rather than by extrusion.

Thinner coatings

Of great importance in radio and switchboard wiring is the fact that insulation from GEON latex can be applied in much thinner coatings than can normally be obtained from extrusion. That means easier handling, lighter weight, and more conductors in a given space.

Used with glass insulating tapes, GEON serves two purposes—as a thin coating of insulation with good heat and chemical resistance; as a binder for the glass fibres to give them high flexibility and long life.

Semi-conducting coatings

Thanks to special compounding made possible with GEON latex, semi-conducting coatings of this material provide much greater conductivity than can be had with extrusion compounds.

More improvements to come?

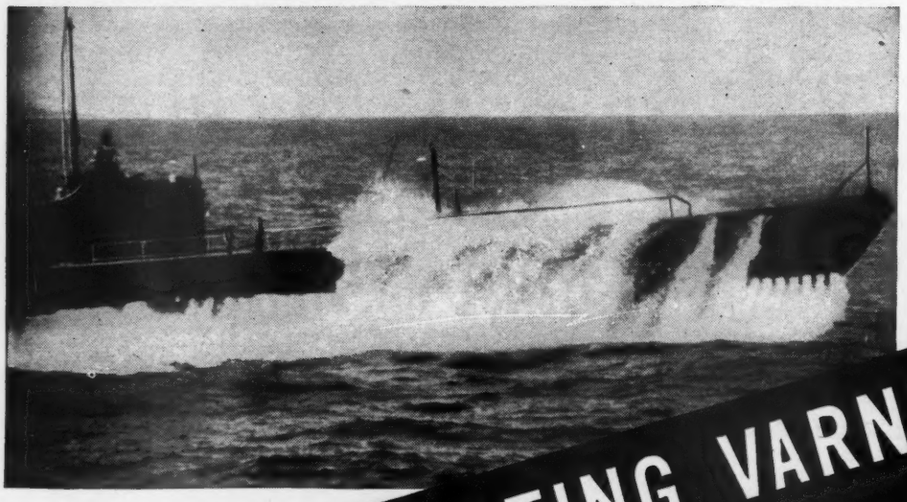
These are some of the advantages of GEON latex that are already apparent. It is likely that additional ones will be uncovered as the material is used more and more broadly.

We suggest that you consult with your supplier of wire and cable regularly to keep abreast of the steady improvements in insulation that are being made possible by GEON polyvinyl materials. Or for help with special problems or applications please write Department Y2, B. F. Goodrich Chemical Company, Rose Building, Cleveland 15, Ohio.

Geon
Polyvinyl Materials

B. F. Goodrich Chemical Company A DIVISION OF THE B. F. GOODRICH COMPANY

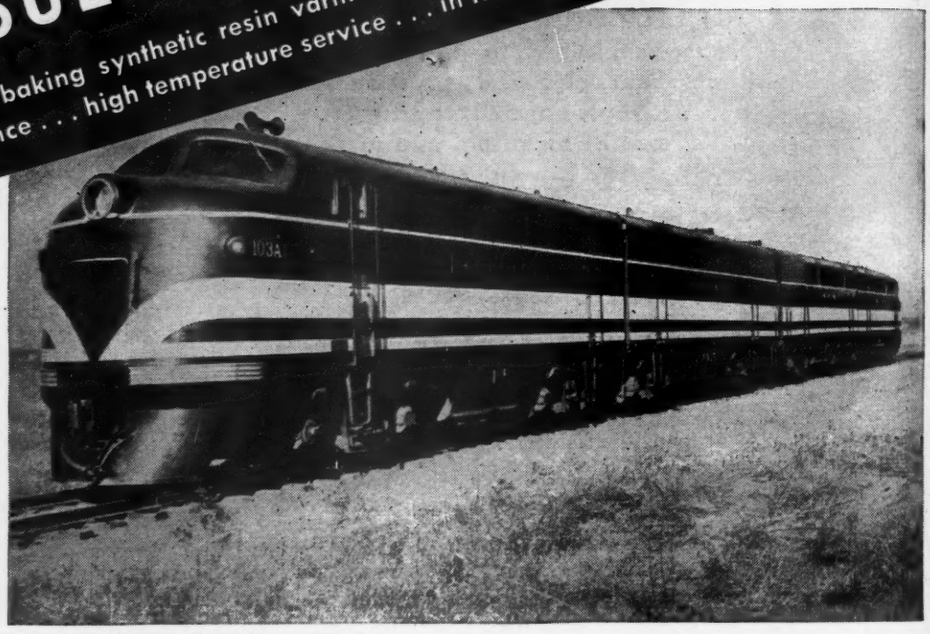
No electrical equipment can be any better than its insulation



This insulating varnish helped give range to our "Silent Service" . . .

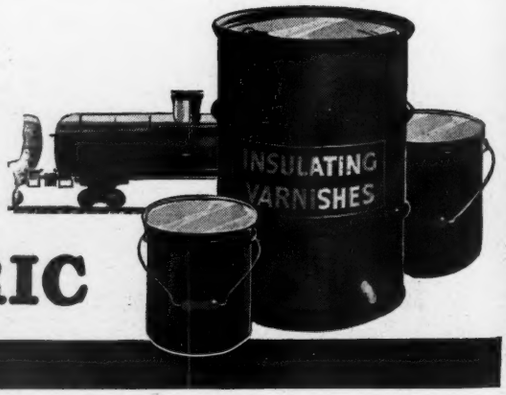
G-E INSULATING VARNISH 1678

A clear baking synthetic resin varnish . . . excellent for moisture resistance . . . high temperature service . . . in large electric motors.



. . . and the same varnish can make a more dependable Diesel electric drive

The excellence of G-E Insulating Varnishes is backed by 45 years of experience in research and manufacture. Millions of gallons of these varnishes were supplied for war uses. Now General Electric's huge varnish production capacity—plus expert technical service—is available to peace industry. G-E Quality Control is your assurance of uniformity in every shipment of G-E Insulating Varnishes. For full details consult your local General Electric Merchandise Distributor. Or write direct to Section RIMA-265, Resins and Insulation Materials Division, Chemical Department, General Electric Company, Schenectady 5, New York.



GENERAL ELECTRIC

CD 46-18

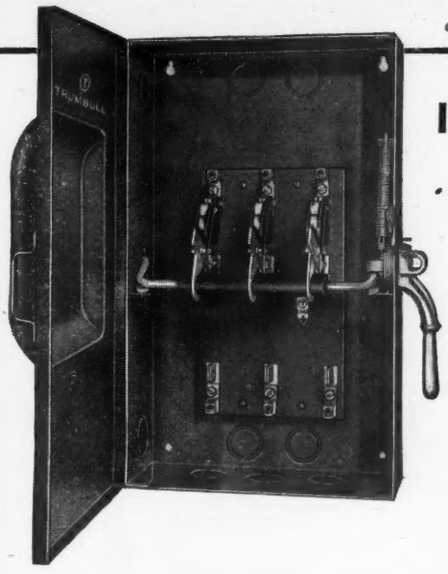
G-E INSULATING VARNISHES

G. E. OFFERS A COMPLETE LINE OF INSULATING MATERIALS

TRUMBULL

ENCLOSED SAFETY SWITCH

. . . . . for heavy duty



IT'S A PIONEER . . IT'S BASIC . . IT'S TYPE "A"

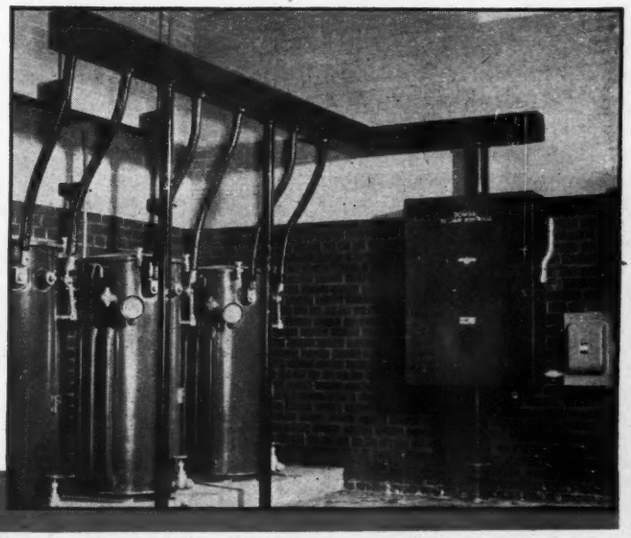
. . . *with* TRUMBULL ENGINEERED EFFICIENCY

Trumbull type "A" is basic . . . built to the true intent of type "A" specifications . . . not an intermediate switch with "gingerbread" added.

The compact unit has few parts, each made from the best of material, carefully machined to insure smooth positive operation and maximum safety. We have always adhered to our determination to maintain the type "A" at the highest standard in all respects.

That we have done so is evidenced by customer preference for 46 years . . . even before the type "A" was enclosed. Inherent simplicity . . . all parts visible . . . releasable interlock and sturdy construction make type "A" a leader item for you to purchase or specify.

With correct determination of capacity and application . . . and due consideration for nature of load and the fuses that will be used you will find Trumbull the best and most economical heavy duty switch you can buy.



Trumbull type "A" installed on load side of transformers. Controls electrical kitchen equipment in group of barracks. Small switch feeds building adjacent to transformer vault.

THE TRUMBULL ELECTRIC MANUFACTURING CO.

PLAINVILLE, CONNECTICUT

OTHER FACTORIES AT

NORWOOD, OHIO — LOS ANGELES — SAN FRANCISCO — SEATTLE

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CONTRACTOR EDITION

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SYLVANIA LAUNCHES BIG PROMOTION OF NEW INFRA-RED LAMPS FOR THE HOME

Advertising, National Contest Build Wide Interest in Handy Lamps

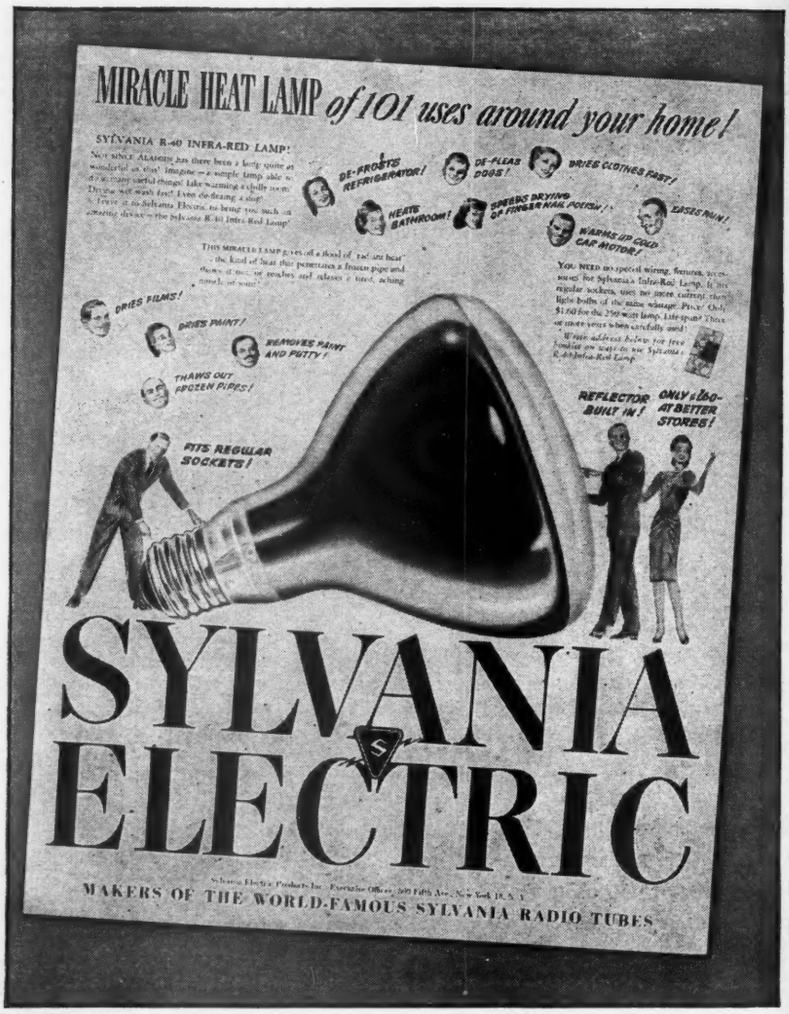
New INFRA-RED lamps, designed especially for use in such places as the home, on the farm, in greenhouses, garages and hospitals, are receiving wide promotion by their manufacturer, Sylvania Electric.

These R-40-type lamps, of 250 and 375 watts, are being featured in full page ads this month in *The Saturday Evening Post* and *Ladies' Home Journal.* Other ads will cover many fields in trade publications. Also, a national Hobby Contest, for the most interesting new uses for home INFRA-RED lamps, will be announced soon in *Popular Science* and *Popular Mechanics.* Big cash prizes will be awarded to stir enthusiasm over these new miracle lamps.

News releases, publicity, circulars and educational material are also helping to speed the time when INFRA-RED lamps will be standard equipment in every home. The low cost of the lamps, the fact that they can be screwed into an ordinary light socket and their many practical applications assure their popularity.

HOME INFRA-RED—Lamp of 101 Uses

1. **HEATS . . . bathroom, chicken coop, hunting lodge.**
2. **DRIES . . . hair, wet paint, photo films, laundry.**
3. **PENETRATES . . . aching muscles, frozen pipes. Defleas dogs.**

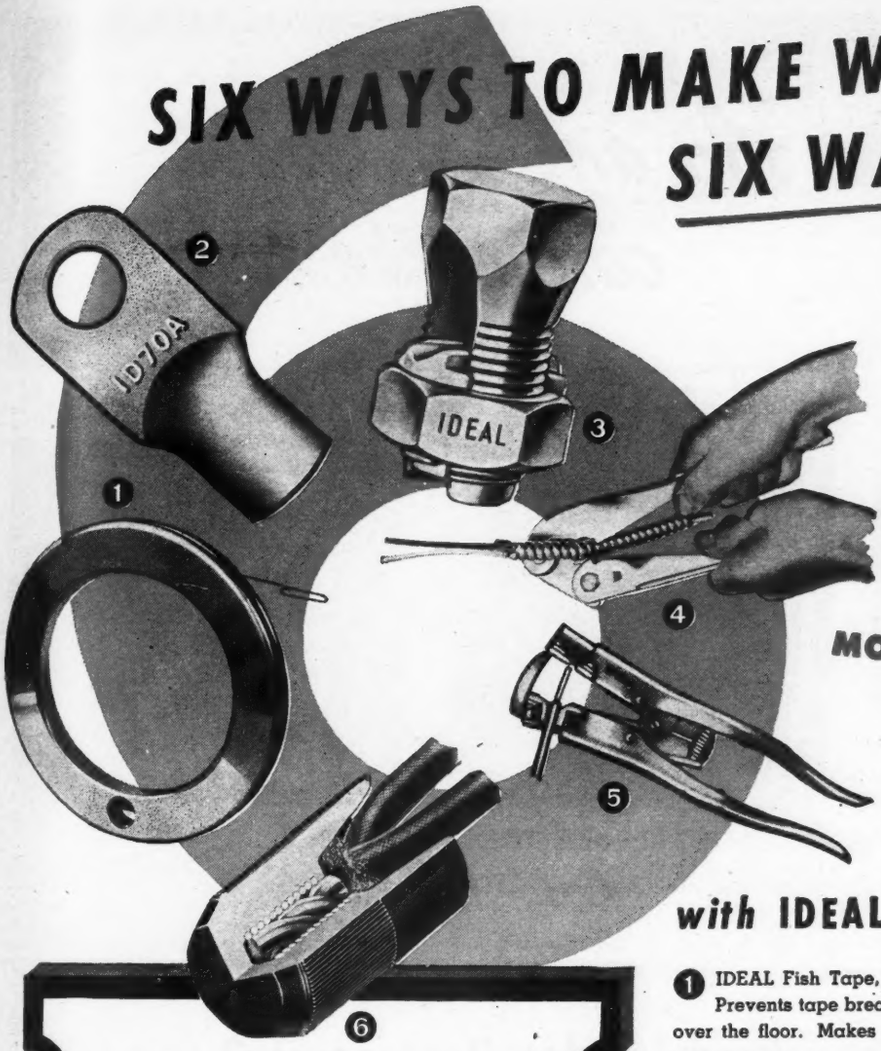


This ad means business—for *you.* It is selling the new Sylvania 250 and 375 watt INFRA-RED lamps, designed specially for home use, to millions of readers of *The Saturday Evening Post* and *Ladies' Home Journal.* Don't fail to take advantage of the big profit opportunities in selling these popular new home appliances.

SYLVANIA ELECTRIC

MAKERS OF FLUORESCENT LAMPS, FIXTURES, WIRING DEVICES; ELECTRIC LIGHT BULBS; RADIO TUBES; CATHODE RAY TUBES; ELECTRONIC DEVICES

SIX WAYS TO MAKE WIRING JOBS SIX WAYS BETTER!



EASIER

SAFER

NEATER

FASTER

MORE CRAFTSMANLIKE

LOWER COST

with IDEAL WIRING DEVICES

❶ IDEAL Fish Tape, Reel and Puller: Three tools in one. Prevents tape breakage, kinking or springing around all over the floor. Makes wiring faster, better, easier. 8 sizes.

❷ IDEAL Lugs (solder and solderless): Made of High Quality Pressed Copper. No sharp edges or burrs. Uniform size. Approved by Underwriters' Laboratories, Inc.

❸ IDEAL Split Bolt Connectors: Make permanent or temporary solderless connections. Made in bronze, brass or aluminum. Two types, "one piece" and "two piece" with either small or large heads, all sizes. SERVICE ENTRANCE CONNECTORS also available.

❹ IDEAL B-X Armor Cutter: Snip — and the B-X cable is cut, with this handy pocket size tool. Cuts either two or three wire, No. 12 or No. 14 cable. Cuts cleanly—quickly—without injury to wire insulation. Steel cutting blade removable for sharpening.

❺ IDEAL Wire Strippers: "E-Z" Hand Type (Stripper and cutter) a handy tool for stripping stranded and solid wire. 2 models—"Automatic" and "Standard." The IDEAL line of hand, foot and electrically operated Wire Strippers is most complete on the market.

Write for Detailed Literature

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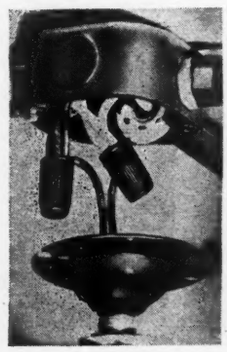
IDEAL "WIRE-NUTS"

Make wire joints the modern way — no solder or tape, no heat; simply strip wires, screw on, that's all! Safer wire joint! Better electrically—Stronger mechanically. Accepted as standard in wiring—new circuits, re-wiring, plant changes, re-locating machinery, etc. IDEAL'S **new low prices** further cut wiring costs.



A size for every job — Four sizes make all common combinations from Two No. 18 to Three No. 10 solid or stranded wires. MILLIONS IN USE. Approved by Underwriters' Laboratories, Inc.

Free Samples on Request

PROMPT DELIVERY

1578

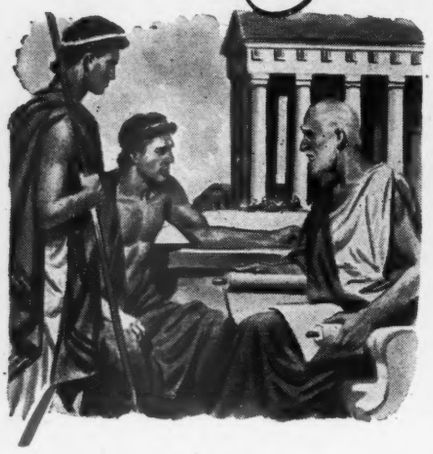
Wiring Device Division
IDEAL COMMUTATOR DRESSER CO.
1041 Park Avenue — Sycamore, Illinois

IDEAL *Sycamore*

Sales offices in Principal Cities — Consult local telephone book
In Canada: IRVING SMITH, Ltd., Montreal, Quebec

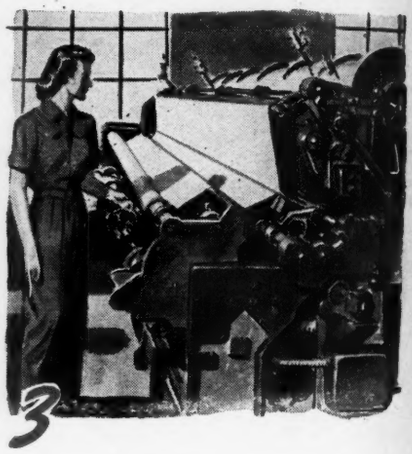
Old Reliable Red Band Says—

"An ancient Greek called the turn"



When an ancient Greek philosopher once predicted that "Human slavery will continue until the loom weaves of itself," he really called the turn of important events to come. Events destined to free men from slavery . . . cut the costs of goods . . . raise the standard of living—

In early colonial days in our country, our forefathers were still spinning and weaving by hand, as the early Greeks did, to make clothing for the family. The driving force that was to mark another important milestone in man's progress, was still to be discovered—



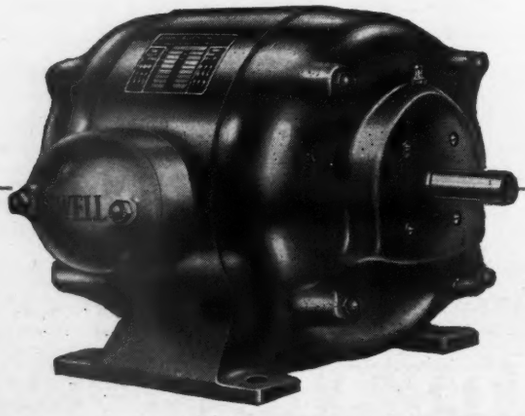
Today, not only the loom but machines, which make products numbering into thousands, turn by themselves with electrical horsepower. Howell—a specialist in industrial type motors for more than 30 years—builds motors for many of these machines from ¼ to 150 h.p.

Have you a hard job for Horsepower?

Years of specializing in making industrial type electric motors to meet the exacting requirements of the automotive, machine tool, dairy, food and other important industries, have enabled us to make Howell Motors better than ever.

Today, as always, Howell Motors are quality-motors. They are smooth-operating and quiet, too, because they are statically and dynamically balanced. They are better performing because they are built of the finest materials—copper or bronze rotors—and completely insulated. They are trouble-free on the job because they are designed for the toughest tasks in industry—consequently, they perform better on all jobs.

For your needs, in specialized or standard motors, from ¼ to 150 h.p., phone the nearest Howell Representative. Remember, you pay no more for industrial type Howell Motors . . . but you always get top quality for your money.



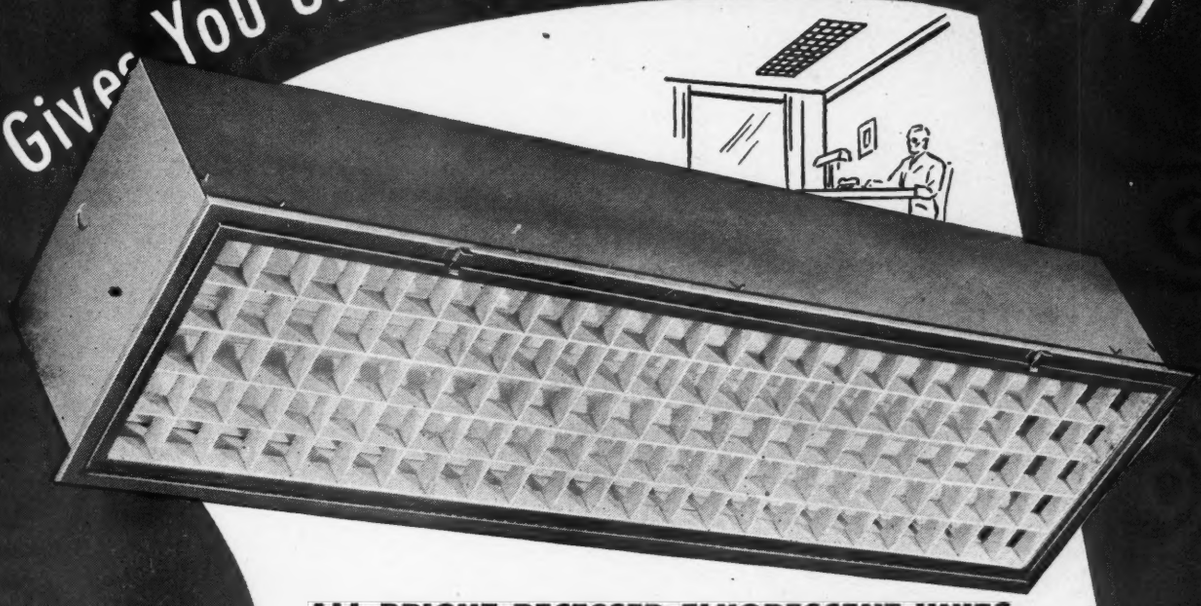
Howell Protected Type Motors available in sizes 5 h.p. and smaller. Also other sizes of Howell industrial type motors available up to 150 h.p.

HOWELL MOTORS

HOWELL, MICHIGAN

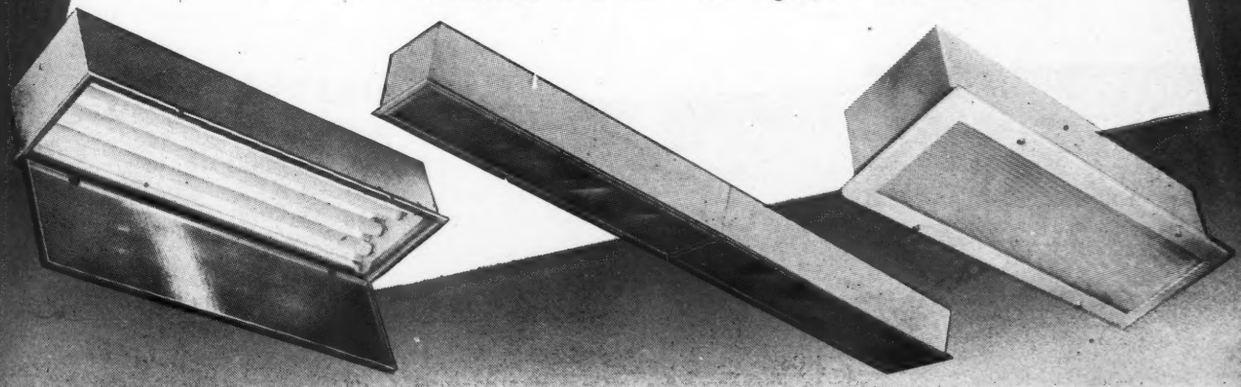
Manufacturers of Quality Industrial Type Motors Since 1915

All-bright Gives You Unhampered Lighting Beauty



ALL-BRIGHT RECESSED FLUORESCENT UNITS FEATURE "NEW TELESCOPIC FRAME"

For efficiency, performance and beauty, here is the ultra in recessed fluorescent fixtures. Designed for unhampered beauty, they feature a sturdy, *telescopic frame that fits snug to the most uneven ceiling.* Special piano hinged and "quick-slide" catches for easy, simple maintenance. Available with egg crate or honey-combed louvre. Individual or continuous rows. *For better sight, it's ALL-BRIGHT.*



Quick, simple maintenance with piano hinges.

An all-purpose unit . . . individual or continuous rows.

Small sized units available for special-type installations.

FOR A BRIGHTER WORLD

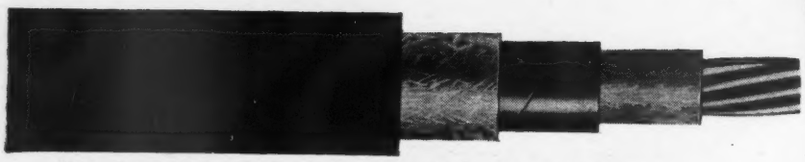
Send for new descriptive catalog, today!

ALL-BRIGHT ELECTRIC PRODUCTS COMPANY

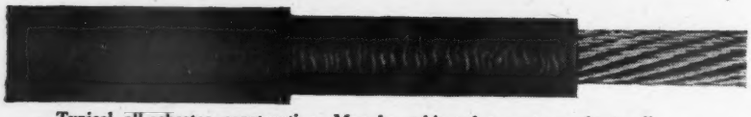
Manufacturers of Fluorescent Lighting Fixtures

3917-25 N. Kedzie Ave. Chicago 18, Illinois

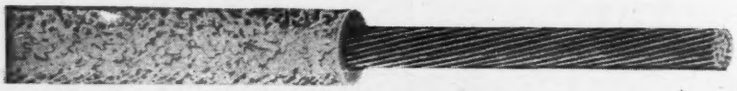
Where HEAT is your wiring



Asbestos, varnished cambric, asbestos and asbestos braid. Resists heat, flame, moisture, oil, grease and corrosive fumes and has high dielectric strength.



Typical all-asbestos construction. May be subjected to extreme heat, oil, grease, corrosive fumes.



For electric ranges, furnaces, and other heating appliances.

OTHER U·S·S AMERICAN ELECTRIC WIRE & CABLE PRODUCTS

- New PS Conducting Rubber Shielded Wire and Cable.
- Ampyrol — Synthetic-insulated wire and cable for switchboards and machine tools.
- Amerclad — Tough abrasion resisting cable for portable tools, motor leads, power cable.

U·S·S American Amerbestos Wire & Cable

problem you can depend upon

AMERBESTOS

This asbestos-insulated cable insures long-lived performance under the most severe operating conditions

EXTREME HEAT - FLAME - OIL and GREASE - CORROSIVE FUMES MOISTURE

FOR *tough* jobs, engineers specify a *tough* cable—a cable that packs all-round fine performance. That's why thousands of miles of U·S·S Amerbestos Wire and Cable have been used for installations where unusual and exacting requirements must be met.

U·S·S Amerbestos Cable has proved its ability to solve many difficult wiring problems. It has been used for power and control in our fighting ships, where resistance to torrid heat, moisture, and rotting is needed. Its permanent flexibility recommends it for electric heating appliances and ranges. Its resistance to flame, oil, grease, and corrosive fumes has made it widely used for locomotives and hot locations in power plants.

Amerbestos Wires and Cables of all types are insulated, in whole or in part, with felted asbestos, which is spun around the copper conductor, impregnated with insulating compound, and compressed into an insulating sheath. The covering is firm, flexible, uniform in thickness, and seamless. It will not unravel nor unwind, yet can be stripped easily and cleanly from the conductor.

When more dielectric strength is needed, a layer of varnished cambric and a second layer of asbestos felt are added. Where resistance to moisture, oil, grease, and fumes is necessary, the cable is impregnated with MFH black saturant.

If you need electric wire or cable of any kind—for hot spots, wet locations, high current-carrying capacity, or rough use—get in touch with us. Then you will have the right cable for your specific application.

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UNITED STATES STEEL

★★★★4 OF THE 1008 METROPOLITAN ELECTRICAL UNITS *in* RADIO CITY

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At the right are listed various types of electrical control equipment designed and furnished by METROPOLITAN for utilities, industrial plants, large mercantile establishments, and public buildings. Your inquiries are invited.

Knife Switchboards
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ESTABLISHED 1892 METROPOLITAN TRADE MARK

ELECTRIC MANUFACTURING COMPANY

ELECTRIC LIGHTING AND POWER
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LONG ISLAND CITY, NEW YORK

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Measure Values

IN INDUSTRIAL LIGHTING EQUIPMENT

SPECIFICATIONS . . . . . The procedure for developing an RLM Standard Specification requires a thorough investigation and report by a Technical Committee of the Institute, guided by the findings of the Illuminating Engineering Society and other recognized industry associations. These specifications are available without charge to everyone interested.

INSPECTION . . . . . A rigid inspection and testing system, conducted by Electrical Testing Laboratories, Inc. a wholly independent testing organization . . . provides positive assurance that RLM certified Industrial Lighting Units conform to RLM rigid standards of efficiency and economy.

CERTIFICATION . . . . . When equipment so inspected and tested conforms to RLM specifications, the laboratory issues a label of compliance. When you find this RLM LABEL affixed to an industrial lighting unit you know that it has been manufactured in compliance with the exacting procedure developed and administered by RLM Standards Institute.

The RLM Standards Institute is a non-profit organization. Any manufacturer of Industrial lighting equipment may at his own initiative, if he so desires, submit his equipment for RLM inspection and certification. He need not become a member of the Institute. It is only necessary for him to assume his equitable share of the cost of operating the program.

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THE FAILURE OF "FACT-FINDING"

THE PRESIDENT has asked Congress to grant him authority to appoint fact-finding boards to deal with nationally important labor disputes. Most citizens would like to see some reasonable and objective solution of the industrial strife that now is disrupting reconversion. Unfortunately, the record of the "fact-finding" procedure indicates that any claim of impartiality for this process is a gross misrepresentation.

The Administration bill would authorize the President to appoint such boards in cases certified to him by the Secretary of Labor. Each board would report to the President "its findings of fact and such recommendations concerning the dispute as the board deems appropriate." Its facilities and staff would be provided by the Secretary of Labor. The bill provides for an interval of not more than 30 days known as a waiting or "cooling off" period during which it would be "unlawful" (though no penalties are specified) for anyone to promote or encourage work stoppages.

Because the Administration did not wait for Congressional action upon its proposal, but appointed a number of fact-finding bodies to deal with current emergency cases, we have been afforded at least a partial preview of how the procedure may be expected to work out if laws establishing it are passed.

If the reports handed down by the fact-finding panels in the General Motors and oil disputes may be regarded as representative, it can be stated conclusively that Government-appointed "fact-finding" boards will concern themselves to only a minor degree with the establishing of facts. A far greater share of their effort will be concerned with the speculative business of forecasting future output and production efficiency and appraising the "ability to pay" of the companies involved. But the predominant emphasis will be placed upon framing recommendations for settling the disputes in line with announced Government wage-price policy.

In short, the procedure essentially will be one of registering with the public a government opinion as to how far wages may be raised in the cases at issue without raising price ceilings. Both the General Motors and the Oil Panels stated, in quite explicit terms, that this was their conception of the job assigned them.

"Fact-Finding" in Auto and Oil Disputes

As the General Motors Panel phrased it: "This board subscribes to, and has been guided by, the national wage-price policy" — which it summarizes as calling for wage increases to maintain take-home pay at wartime levels, to the degree possible without inflationary price rises.

The Oil Panel was even more forthright in the statement of what it was supposed to do. "In the judgment of the panel," it declared, "the earnings of the workers must be as high as is consistent with both the maintenance of the stability of the price structure and the provision for reasonable returns to the owners of industry." In other words, prices and the return to investors are to remain fixed, with labor entitled to an ever-increasing return up to the limit of what the traffic will bear.

Having thus outlined their respective conceptions of the job, each panel proceeded to carry out its mission.

The Automobile Panel recommended that General Motors increase its basic hourly wage rates by 19½ cents, which amounts to about a 17½ per cent increase on the company's average hourly wage of $1.12. The Oil Panel recommended an 18 per cent increase in basic hourly wage rates, or an additional 21 cents to the average wage rate of $1.20.

The General Motors recommendation was based almost exclusively upon the Panel's calculation that a 19½ cent raise would keep weekly take-home pay equal to that earned in 1944 when the work-week averaged 45.6 hours. The calculation turned on an estimate of what the effective work-week was likely to be in 1946.

The Oil Panel's recommendation appears to have been based on a more complex but no more conclusive accounting. After calculating that the maintenance of July 1945 take-home pay after 40-hour shifts were restored would require a 22 per cent increase in straight-time hourly wages, it recommended that an 18 per cent increase be made. It accounted for 9½ per cent of this by noting that this was needed to cover cost-of-living rises, and explained that the rest was justified by a combination of factors including loss of premium overtime pay, higher productivity, and settlements already negotiated. Since the Panel gave no indication of the weight given to these several factors, it may not be unfair to assume that the last-named was given preponderant importance, since 18 per cent was the increase already granted in collective bargaining by Sinclair and certain other oil companies.

Higher Pay Without Higher Prices

Both panels stated that the pay increases recommended could be met without raising price ceilings, but neither documents its case on this score with very conclusive "facts".

The Oil Panel confined its observations on this account to the statements that only one company in its group had pleaded "inability to pay" and that the industry was in a generally profitable position during 1943 and 1944.

The Automotive Panel stated that, under a number of assumptions about the 1946 operations of General Motors which it believed to be valid, the Company would have higher earnings than it had in 1941, its previous record year. It specifically stated that its findings in the case were not applicable outside the

automobile industry, but it recognized that the General Motors settlement would more or less determine the settlements of other automotive companies. It stated that it had not been able to arrive at a clear conviction as to the ability of other auto makers to pay similar wage advances, but it dismissed the issue by observing that they could expect to operate at full capacity in 1946, and that this should provide savings to offset the increased wage expenditures.

From the management point of view, one of the most serious limitations in the panels' procedure was their failure to deal with any of the Company claims put forward. In ordinary collective bargaining the demands of both sides are advanced and concessions in one direction are traded for concessions in the other. Here, although the companies involved had insisted upon their need for guarantees against contract violations and wild-cat strikes, and for other union concessions, nothing but the wage issue was considered by the "fact-finding" bodies. The General Motors Panel specifically recommended that the wage increase of 19½ cents be granted, but that otherwise "the status quo prevailing before the strike be restored by the reinstatement of the 1945 contract between the parties." Handled thus, fact-finding becomes indeed a wholly one-sided exercise.

Both panels accepted, quite uncritically, the general position taken by Government spokesmen that wage increases are inflationary only if they are directly translated into price advances. It should be obvious that all wage increases add to the inflationary pressure, if made at a time like the present when consumer purchasing power far outstrips the volume of goods and services available to satisfy it.

"Fact-Finding" Dodged in Steel and Rails

It is ironic, too, that even while the Automotive and Oil Panel groups were holding the "government policy" line, the President and his Reconversion and Stabilization Directors were busily at work trying to dent it. In the steel dispute, although price rises in this industry have a particularly sharp inter-industry impact, hearings by the appointed fact-finding board were deferred while negotiations were carried forward by the President and his advisors under which the industry was offered a price increase of approximately $4.00 a ton on condition that U. S. Steel and the United Steelworkers agree upon a mutually acceptable wage boost. It is hard to avoid the cynical conclusion that wage increases constitute the major administration policy, and that the principle of not translating them into increased prices is sacred only in those cases where there can be some reasonably plausible showing that wages may be raised without price advances.

Much the same general conclusion — that the "facts" are controlling only if they support a substantial wage increase — is sustained by the history of the administration of the Railway Labor Act of 1926, often cited as a glowing example of how "fact-finding" by so-called Emergency Boards of Presidential appointees has served to prevent strikes on the railroads. It is true that reports of almost all of the 31 Emergency Boards appointed to look into threatened railway strikes in the 20 years since the act was passed have provided the basis for a settlement of the disputes in question. The fact — a real fact — remains, that in 1941 and again two years later the wage adjustments found appropriate by Emergency Boards in major railway labor disputes were revised upwards at the White House after the unions involved rejected them as unsatisfactory and threatened to strike. The second upward revision was made after government seizure of the railroads to prevent a national transportation tie-up. When the "facts" did not indicate a large enough wage increase to satisfy the union and the Administration, the "facts" went out the window.

It would be irresponsible to deny the importance of finding some tenable solution of current disputes that threaten to completely disrupt the reconversion process. But upon the evidence of experience, "fact-finding" boards cannot be expected to operate according to the common conception of their function — as agencies designed to sift out for the public an objective and significant weighing of the facts behind conflicting claims.

Without Principles Facts Mean Little

Facts, if they are assembled upon a sufficiently partisan basis, can be made to document almost any case one wishes to establish. The major difficulty in marshalling facts to resolve wage disputes is that there are no agreed-upon principles to determine the levels at which wages should be set. In the absence of such principles, it is inevitable that "fact-finding" boards, appointed by the Administration, manned largely by those who helped develop and administer Administration wage policies, and depending for technical assistance upon Administration Departments, will serve merely to implement Administration wage policy.

If Government means to reassert its wartime authority to fix wages — an objective specifically disavowed by the President and seemingly wanted by no one — it should accept the responsibility directly, rather than operate to that end through "fact-finding" boards which are independent in theory, but which cannot be so in fact.

The failure of the brand of "fact-finding" now urged upon Congress by the President is evident. Therefore, we must look for a solution along other lines.

What is needed is for labor and management to agree upon the principles that should govern the determination of wages under free collective bargaining. When such agreement is reached, then and only then, can fact-finding become an objective and useful instrument for settling wage disputes.

President, McGraw-Hill Publishing Co., Inc.

THIS IS THE 44TH OF A SERIES

This is the kind of a job that TIREX cables are designed to do satisfactorily. Here is a picture of a cable taking real punishment. Mud, snow, water and abuse, — all of these factors are present and through it all TIREX keeps right on with its unfailing dependability to deliver the current that keeps vital construction machines in operation. TIREX is not sold on a "it must be pampered" basis. TIREX cables take all the tough jobs right in their stride and then ask for more.

The Selenium Rubber Armor which protects the conductors of all TIREX cables is the toughest, most wear-resistant jacket known for wires and cables. The next time you need portable cords or cables that can be depended on be sure you specify TIREX.

TIREX SELENIUM Rubber Armor

Simplex WIRES & CABLES

SIMPLEX WIRE & CABLE CO., 79 SIDNEY ST., CAMBRIDGE 39, MASS.

FEBRUARY . . . . at a Glance

During recent months *Electrical Contracting* has been sampling the opinions of its readers on a number of controversial questions. The first series of questions are presented in the article, "Six Questions" on page 82. By a statistical sampling technique, it is possible to get a fairly high degree of accuracy on matters of opinion which usually reflect the opinion of the whole group. The response obtained on such questions as "Should bare neutral be allowed?" and "Should No. 12 be adopted as the minimum standard for building wire?" are very interesting as a guide to the way electrical construction and installation people are thinking in these times. We hope from time to time to give you more of these opinion surveys.

★

New York City's labor contract made the front pages and the radio news comments on Monday, January 14th, when it was announced. Against a pattern of strikes and rumors of strikes in industries all over the country, the statement of the Joint Industry Board of the Electrical Industry in New York stood out in dramatic contrast. Labor and management have pledged to foster high speed tools, methods and devices to expedite housing construction and to lower housing costs. The story, "New York Agreement to Speed Housing" will be found on page 69.

★

Part of the business of providing good public service is to make it easy for them to reach a contractor and to assure that they get prompt, efficient and courteous attention. In Baltimore, the Electrical Contractors Association of Maryland has set up an electrical contractors' exchange for handling calls from people who need electrical service and do not know a contractor to call. The exchange operates 24 hours a day. It is handled by an impartial telephone answering service. It has brought thousands of dollars worth of good business to Baltimore electrical contractors. You will find the story, "Call Plaza 2300 for Contractor Service" on page 76.

A lighting problem which calls for not only a good understanding of modern lighting principles, but a sound regard for architectural details and good appearance, is the bank lighting job. In Berlon Cooper's story on "Bank Lighting Techniques", page 79, he shows how light is used for architectural and decorative treatment in bank buildings. The modern trend toward simplicity in design has made great changes in traditional methods of lighting banks. You will find the information in this article fairly up-to-date and will be interesting for everyone concerned with commercial lighting, engineering and sales.

★

Electrical wiring and equipment become a functional part of an office routine. Electrical maintenance in office buildings has become, consequently, a vitally important service. In Gus Eckel's article, "Office Building Maintenance" on page 72, he gives us a complete study of an organized electrical maintenance service in Detroit's General Motors office building. Here systematic routine and speedy trouble-shooting for tenants is carefully organized and systematically handled.

★

Continuing Ray Ashley's Estimating series, Part V this month on page 84, gives an accurate unit cost guide for preliminary field estimating of industrial lighting branch circuit wiring. This article, together with the previous articles in the series, is the most complete and detailed field estimating data ever published. Be sure that it is routed to your estimators.

★

The germicidal lamp is one of the new weapons that science has brought to bear on airborne bacteria. It has important market possibilities in schools, factories, institutions and homes. The article, "The Electrical War on Disease" by Dr. L. J. Buttolph, outlines many of the application possibilities for germicidal lamps.

Think how the wire that survives such severe hazards can serve you under normal conditions

Densheath*

TYPE T & TW BUILDING WIRE

Reg. U.S. Pat. Off.

★ Densheath insulation, a synthetic compound, is remarkably durable because of its great density. Finish is smooth, polished.

★ Highly resistant to moisture, acids, alkalies, chemicals, mineral, animal and vegetable oils.

★ Flameproof—won't ignite, burn or support combustion.

★ Surprisingly pliant. No "spring." Retains sharp bends.

★ Superior to any rubber compound in super-aging qualities, resistance to ozone, oxygen and sunlight.

★ Superior to usual grades of rubber insulation in dielectric strength. Good insulation resistance. Low specific inductive capacity.

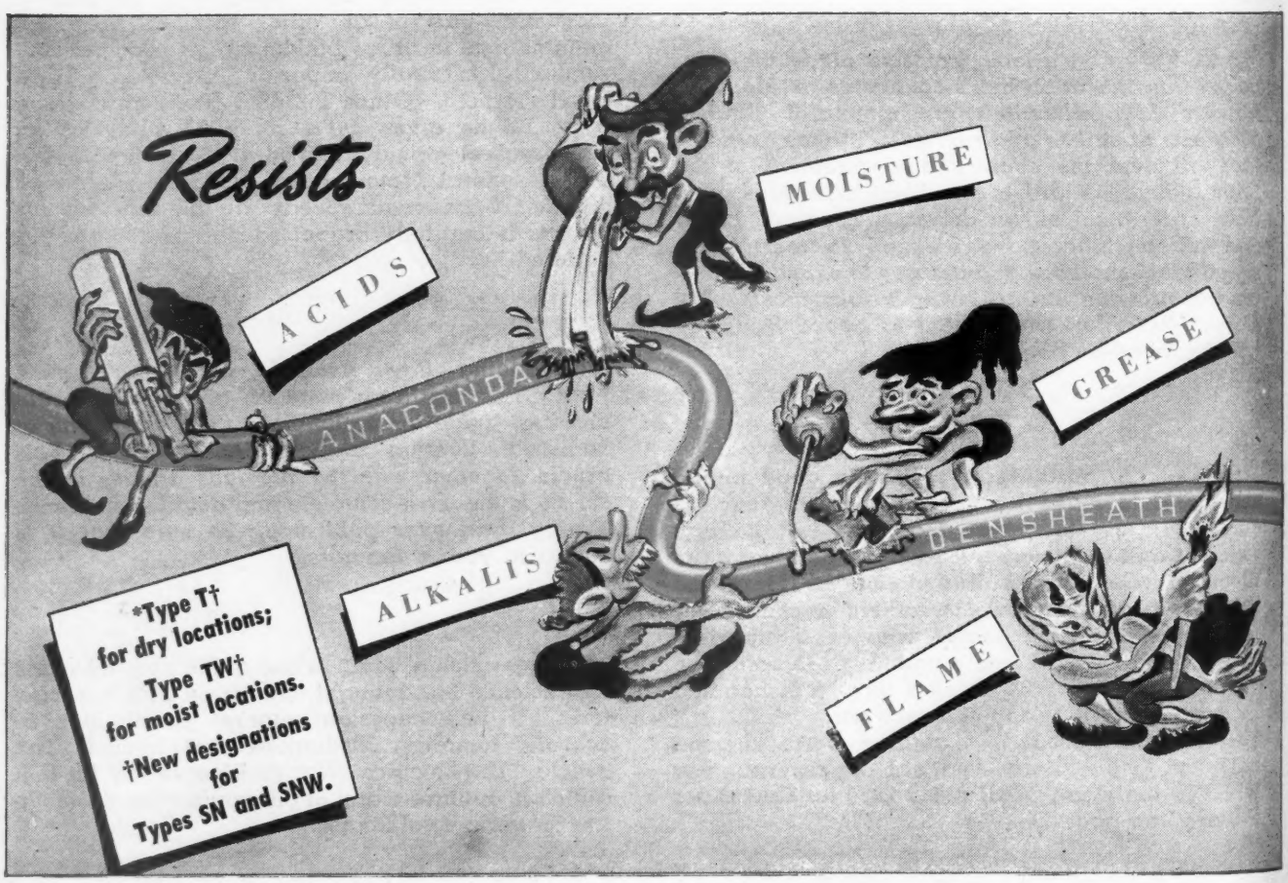
★ Resists reasonable degree of abrasion, tearing, bending and flexing.

★ More circuits per conduit—for new installations, extensions and maintenance.

★ Strips easily; leaves bright conductor.

★ Densheath insulated wire and cable can be used anywhere Type R is allowed.

Densheath is ideal anywhere cables are subjected to extreme conditions. Its flexibility and resiliency fit it for many installations in confined spaces. Available in a variety of colors. Anaconda Wire & Cable Company, Subsidiary of Anaconda Copper Mining Company, General Offices: 25 Broadway, New York City 4; Chicago Offices: 20 North Wacker Drive 6; Sales Offices in Principal Cities.



ANACONDA **ANACONDA WIRE & CABLE COMPANY**

FRACTIONALS AND HOUSE WIRING

About ten years ago fractional horsepower motor repair was pretty much in the hands of the "cellar shops." The shops with machinery, highly skilled help, orderly routines, and the procedures normal to repairing big motors couldn't compete. Some even farmed out fractionals to the "cellar shops" or handled them at a loss just as a service to their regular customers. Fractionals offered a very large repair market, but there was no profit in it.

Today there are shops in most industrial areas where fractionals are as welcome as integrals. Repairs are cheap but profitable. It was done by developing specialized departments devoted exclusively to fractionals, by streamlined production, by eliminating paper work and handling jobs on a large volume basis.

The modern shop for repairing fractional horsepower motors is a distinct unit separted from the rest of the shop. It operates on its own schedule and uses its own system of pricing and accounting. It turns out better repair jobs cheaper.

Is there a lesson here for house wiring? The market, everyone admits, is enormously large for at least the next ten years, probably longer. But electrical contractors are not too optimistic about the profit potential. Curbstoners will set the prices, and we can't compete, they say. So some contractors who know they ought to be taking the lead in new house wiring are reluctantly passing it up for other fields of activity which show greater profit potentials.

The coming market for house wiring, however, is far too great and too important to measure by the limited experience of the thirties or study with the same logical premises of that period. The average number of outlets is much greater today. The average job is more extensive and more complex. And the number of jobs available is several times as great.

When motor shop men began to study the repair of fractionals as a mass production problem, they came out with reduced costs. When contractors tackle the wiring of houses as a mass production problem, they too are going to find economies that can bring prices down to competitive levels. The use of power tools is still extremely rare. The organization and scheduling of houses in groups rather than as individual jobs still needs to be explored.

House wiring, like fractionals, can be treated as a specialty handled on a volume basis. The job methods, labor, tools, materials, supervision, accounting and overhead can be applied and allocated as a departmental operation. And out of competent management the areas where costs can be cut and operations improved can be found.

Residential wiring and lighting is a field that deserves the best ingenuity, engineering and management that the industry has to offer. It needs systematic development as a market that can come along only as profit opportunities attract good minds and aggressive business organizations into the field.

Wm. T. Stuart

Communication

any type your customers prefer

GRAYBAR OFFERS COMPLETE VOICE AND SIGNAL SYSTEMS — OR INDIVIDUAL DEVICES — FOR YOUR CUSTOMERS' BUILDINGS . . . SPECIALIZED HELP . . . FASTER DELIVERY!

• Whether your customers want a complete voice-to-voice communication system or signal system — or a single signaling device — Graybar can provide exactly what you need to satisfy their requirements. We distribute Webster Teletalk intercommunication systems, Edwards Lokator paging systems, public-address systems, fire-alarm systems, electric bells and buzzers, industrial horns, sirens, howlers, annunciators, and all accessories for them.

A Graybar Specialist will gladly help you in selecting and applying the best items for each customer's needs. In many cases, delivery from the nearby Graybar warehouse can save time. You'll find Graybar's service helpful also in obtaining other electrical supplies, equipment, and tools. *Graybar Electric Company, Graybar Building, New York 17, N. Y.* 4621

IN OVER 90 PRINCIPAL CITIES

ADEQUATE WIRING — THE KEY TO THE HOME OF TOMORROW

Everything for Electrical Contractors via GraybaR

A. Lincoln Bush, Chairman of the New York Joint Industry Board of the Electrical Industry.

NEW YORK AGREEMENT To Speed Housing

New York electrical contractors and union to develop modern technological methods and use high speed tools and devices to speed up New York housing construction.

By W. T. Stuart

IN dramatic contrast to widespread labor strife over the country, New York electrical contractors and powerful Local 3 of the I.B.E.W. announced a 1946 agreement which is intended to put the full weight of the contractors and the union behind a speedy home and housing program. A. Lincoln Bush, Chairman of the Joint Industry Board of the Electrical Industry for the contractors and Harry Van Arsdale, Jr., Business Manager, Local 3, on January 14 announced an agreement which, it is hoped, will be followed by other construction trades to stimulate business, make jobs, and help to solve the urgent and seriously critical housing shortage of the Metropolitan area.

The announcement, coming as it did, amid growing strikes and threats of strikes in national industries, was front page news in New York's principal newspapers and the subject of congratulatory editorials and discussion by radio commentators.

In a broad gauge action of labor-management statesmanship, the participants renounced the usual bargaining to bring their combined strength to bear on the housing crisis. The new agreement pledges—

No strike—No lockout

No increase in wage rates

Waiver of time and a half rates for two 7 hour shifts on housing construction.

Sanctioning and promoting labor-saving tools, methods and management.

E. A. Kahn, President of the New York Electrical Contractors' Association.

S. J. O'Brien, Vice Chairman of the New York Joint Industry Board of the Electrical Industry.

Increased pension and disability benefits.

In an area as tightly organized as the New York building trades, the new pact is practically unprecedented. Approaching the sensational was the formal announcement in which the union urged: "The use of the most modern technological methods and the unrestricted use of high speed labor-saving tools and devices, in order to reduce the cost of low-rental housing and to make new dwellings available as soon as possible for returning veterans."

The new contract affects 364 electrical contractors and over 10,000 skilled electrical construction workers in the New York City area. The formal announcement as issued by A. Lincoln Bush and Harry Van Arsdale, Jr. is as follows:

"In the midst of the wave of labor-management discord now sweeping the country, employers and workers of the electrical construction industry in Greater New York announce a no-strike, no-lockout agreement for the duration of the existing housing crisis.

"In making public the terms of the agreement, A. Lincoln Bush, Chairman of the Joint Industry Board of the Electrical Industry, said that the International Brotherhood of Electrical Workers, Local 3, in addition had voluntarily agreed to relinquish its contractual right to time and a half for overtime and offered to work two seven-hour shifts, both shifts at regular time until the housing shortage abates.

"In a move described as 'unprecedented in the construction industry,' the union also sanctioned the use of the most modern technological methods and the unrestricted use of high-speed, labor-saving tools and devices in order to reduce the cost of low-rental housing and to make new dwellings available as soon as possible for returning veterans.

"More than 10,000 electrical construction workers and 364 electrical contracting companies are affected by the terms of the new agreement.

"In a statement, hailing the benefits to the public contained in the contract, Mr. Bush said: 'All of this has been made possible by the harmonious relationship that has existed between the employers and the union over a long period of years. It should now be possible for large-scale housing to get under way and to be completed at reduced cost to the public in record time.

'The Joint Industry Board of the Electrical Industry, representing both labor and management in this key field, hopes that other trades in the construction business will follow its lead and make possible still further reductions in cost and time.'

"Mr. Bush said that the unorthodox terms of the agreement were accepted by the union because employers in his industry have sponsored a comprehensive program of workers' social benefits. These include, he said, hospitalization benefits for both husband and wife, disability payments, and old-age pensions, which in the case of men over 65, guarantees a total monthly income of $100.

"Harry Van Arsdale, Jr., business manager of Local 3, also expressed satisfaction concerning the new understanding in the industry. He said: 'At a time when thousands of our returning veterans are unable to find homes for themselves and their families, both labor and management must find ways to cut corners in order to hasten construction and lower the cost of housing to the consumer. I am satisfied that we have made an excellent beginning.'

"Among the functions of the Joint Industry Board, Mr. Bush pointed out, were the administration of uniform labor

agreements, acting as administrative agent for the Pension Committee for the industry, and adjudication of disputes in situations not covered directly by employer and employee representatives."

Negotiations for the contract began on October 11th with both parties to the agreement eager to do something to speed housing construction and cut costs as well as to enlarge upon the security benefits of the existing contract, particularly in the field of hospitalization, disability benefits, and pensions. On January 9th, the Joint Industry Board adopted a resolution sponsoring a plan of two shifts of seven hours each at straight time on low-cost housing, and providing for the use of high speed labor-saving tools.

The Joint Industry Board consists of a panel of three officers and 18 other members, A. Lincoln Bush, Chairman, S. J. O'Brien, Vice Chairman, and Dennis J. Crimmins, Executive Secretary and Treasurer. For the contractors, the members are Robert E. Denike, Louis Freund, Julius Hoffman, E. A. Kahn, Louis Lidsky, Benjamin Salzhauer, Irving Faerman, and Herbert Josephson. For the union, the members are Naftel Bedsole, Nat Chadwick, Albert Hassemer, John J. Kapp, John K. Lapham, Edward J. McAlinn, Edward P. McGonegal, Michael Siegel, Jere. P. Sullivan, and Harry Van Arsdale, Jr.

Harry Van Arsdale, Jr., Business Manager of Local 3, International Brotherhood of Electrical Workers, A.F.L.

The Joint Industry Board of the Electrical Industry is set up for the administration of the agreement and working rules. The groups represented are New York Electrical Contractors' Association, Inc., Master Electrical Contractors' Association, Inc., Joint Committee of Contractors Associations (consisting of Bronx Electrical Associates, Inc., Electrical Estimating and Credit Bureau of Queens, Inc., Greater City Electrical Contractors' Association, Inc., Midtown Electrical Associates, Inc.) and Local Union No. 3, International Brotherhood of Electrical Workers, American Federation of Labor.

THE NEW YORK LABOR AGREEMENT—*AN EDITORIAL*

IF we ever approach the level of building activity needed to relieve the national housing shortage, it will take more electricians than we have or can train. If we have the most modest success in selling adequate wiring and planned home lighting, the available manpower working in traditional ways cannot hope to do the job.

The construction industry has been condemned on numerous occasions for lack of progress and for expensive handicraft traditions which combined with high labor rates has pushed the new house farther and farther beyond the reach of ordinary wage earners. Yet the industry has plenty of men who are ingenious in the use of materials, skillful in management and astute in business.

In our great metropolitan areas the contractor has always had to contend with powerful labor unions imbued with organized labor's traditional reluctance to accept machines, power tools, methods or materials that reduce the number of available labor hours. This resistance to higher unit production per labor hour is rarely, if ever, evident in labor agreements. It is unwritten law. Those who have tried to buck it got into expensive and involved controversies with the union, or there were accidents and job interruptions.

A number of writers seeking sensational aspects of union work limitation have generalized from specific cases to show enormous direct economic losses. Such over-emphasis is just as naive as it would be to underestimate the effects of traditional handicraft methods in a machine age. The loss and the serious economic effect lies in its restraint upon management ingenuity.

In New York's new labor agreement, one of the most powerful and most solidly entranched trade unions in the country is clearly on record as sanctioning the use of the most modern machines and methods to speed housing. Together with their employers they intend to put their full weight into solving the housing crisis. And the challenge goes out to the rest of the construction industry to follow. Here is labor-management statesmanship. And it is altogether fitting that the leadership toward mechanizing and modernizing construction methods should come from the electrical industry. It is a product of modern technological progress. It is an essential ingredient of most of the physical aspects of modern living.

There is boom construction ahead. There is, unquestionably, a new emphasis on functional elements of housing in which electrical work plays an ever increasing role. Far-sighted policy in the development of higher productivity per man hour can turn the boom into a new golden age of building.

We have in the construction industry some of the best brains in the world. That's proven fact. The U. S. Army Engineers, the Sea-Bees, The Signal Corps and similar technical units of the armed service astonished our allies and appalled the enemy. The skill and ability of American mechanics and construction workers is unchallenged anywhere. The capacity of American manufacturers to provide materials at low cost is unquestioned. Do we have the labor-management statesmanship to act as the catalyst, to bring these powerful assets together, to give them purpose and direction and coordination? The New York agreement says we have, pointing to a new era in modern living.

Office Building MAINTENANCE

Organized maintenance assures electrical service continuity at Detroit's General Motors Office Building. Systematic routine speeds tenant trouble call service.

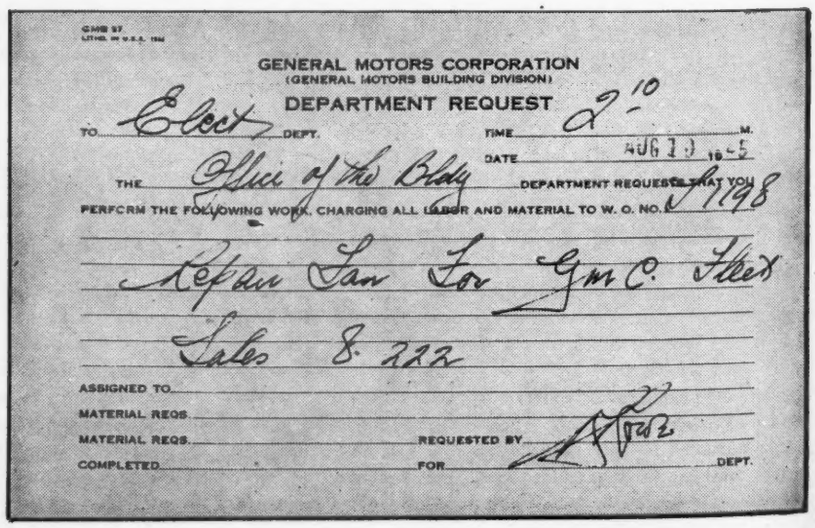
Chief Electrician H. W. Schusler, a stickler for efficient organization, has built up an enviable file of electrical and maintenance records; has all the information at his finger tips.

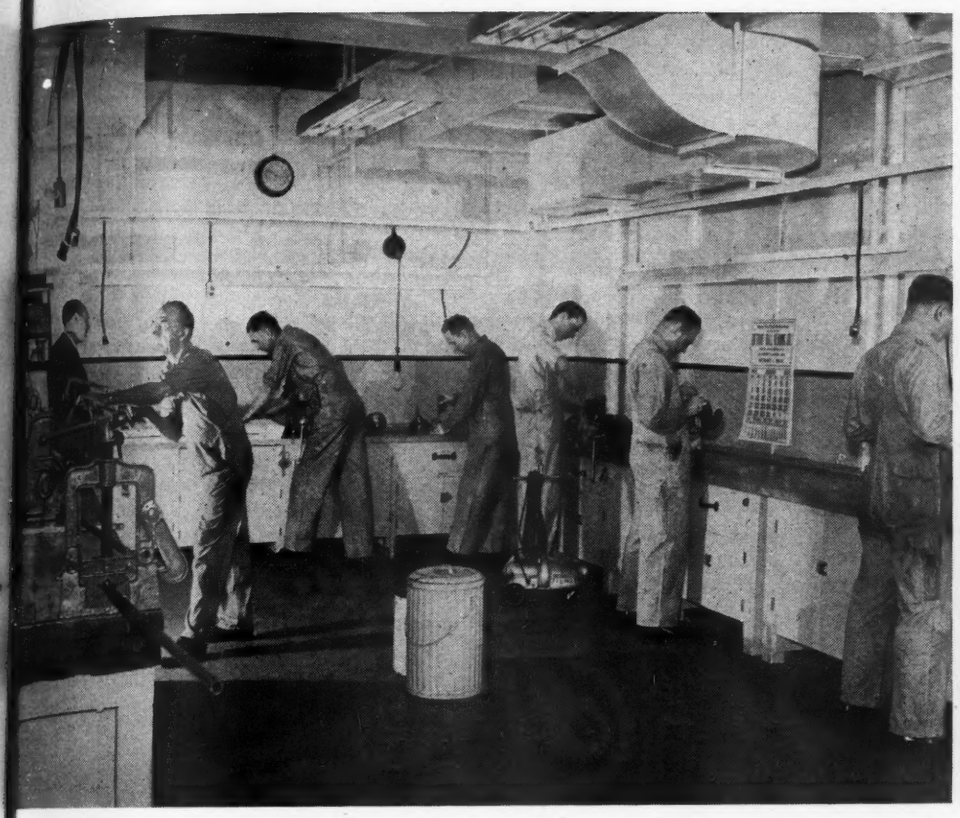
By August Eckel

TOO often, commercial building electrical maintenance is sadly neglected and relegated to the catch-as-catch-can or "fix-it" category of management responsibility. Like industrial plants, this condition is more prevalent in the smaller buildings where a handy man or two handles *all* the maintenance chores and no up-to-date record of electrical system conditions is available. Larger buildings are more apt to have a carefully organized electrical department to develop preventive maintenance and expedite urgent trouble calls. Electrical service is just as vital in the modern business office as in the production plant.

Outstanding among well organized, efficient, maintenance departments is that of the General Motors Office Building in Detroit. Here, a thoroughly systematized routine enables a crew of twelve electricians to satisfy the electrical maintenance requirements of some 2,200 offices in the building—this in addition to a highly organized preventive maintenance program and the inherent "maintenance construction" work required by tenant shifts and changes. Although somewhat different in nature and scope, this commercial building maintenance receives the same detailed attention as does the industrial mainte-

FIG. 1—An Office of the Building request to do repair work for a tenant. Stamped time-ticket "A" together with repair order is used for billing tenant.


GENERAL MOTORS CORPORATION
(GENERAL MOTORS BUILDING DIVISION)
DEPARTMENT REQUEST
TO Elect DEPT.
TIME 2.10 M.
DATE 4-9 19-5
THE Elec of the Bldg DEPARTMENT REQUESTS THAT YOU
PERFORM THE FOLLOWING WORK, CHARGING ALL LABOR AND MATERIAL TO W. O. NO. 1198
Repair San For Gm Co Flrs
Sales 8.222
ASSIGNED TO
MATERIAL REQS
MATERIAL REQS REQUESTED BY
COMPLETED FOR DEPT.



Electrical headquarters at General Motors Office Building is this light, roomy shop. Orderly benches with ample tool storage space, convenient test outlets and good housekeeping depicts well organized department.

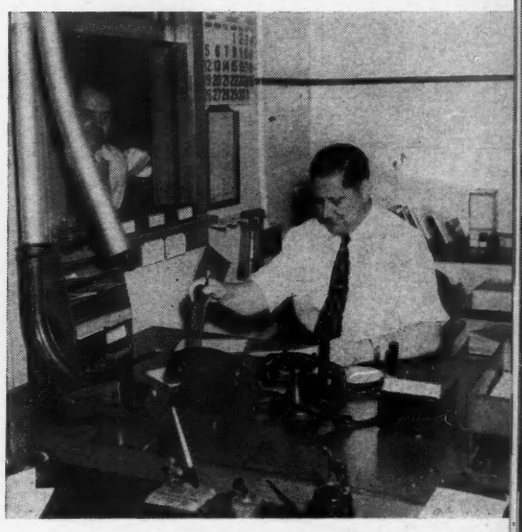


FIG. 2—Maintenance requests are dispatched from this central Service Office to various departments. Desk man has just received a request by penumatic tube from Office of the Building.

nance in the numerous G. M. plants.

All tenant requests for maintenance work at the G. M. Building clears through the Office of the Building. Here, the maintenance order originates as a Department Request (Fig. 1) which is relayed, by pneumatic tube system, to the central Service Office (Fig. 2) where it is recorded and dispatched to the specific maintenance department involved. The man at the S.O. desk merely flips a switch which lights a signal lamp in the electrical, mechanical, decorating or whichever department is needed and the order is picked up. From there on, it is the individual department's responsibility to see that the work is completed.

Electrical maintenance requests are picked up from the S.O. and placed in the bench rack of the electrician handling the specific phase of maintenance indicated on the order (Fig. 3). When an electrician goes out on a tenant request, he stops at the S. O. to "check in." A small yellow time ticket is

FIG. 3—Maintenance electrician scans list of orders placed in his bench rack before going out on the job. Rush orders get first call.

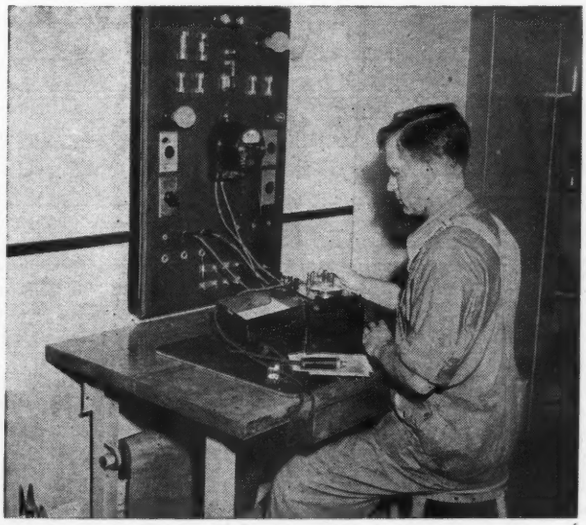


FIG. 4—Service type watthour meters (for submetering tenants) are calibrated with a rotating standard at regular intervals.

FIG. 5 — Spare stock of watthour meters ready for installation or substitution for meters needing calibration or repair.

stamped indicating the time he started on the job. When the job is completed he "checks out" and the time again is stamped on the time ticket (Fig 1-A). From the time ticket and the material listed on the "department request" sheet, the Accounting Department bills the tenant for the work done.

The electrical shop, under the supervision of Chief Electrician H. W. Schusler, occupies well lighted, roomy quarters in the basement of the building directly opposite the Service Office. Here all types of electrical maintenance work—from the installation of a cord plug to repairing large oil filled distribution transformers—is done. A separate room (Fig. 4) is used for calibrating and repairing service type watthour meters, some 1000 of which are installed to submeter the various tenants. A stock of spare meters (Fig 5) is maintained for replacement during calibration or repair. Five-ampere meters are calibrated every five years; 100-ampere units every six months.

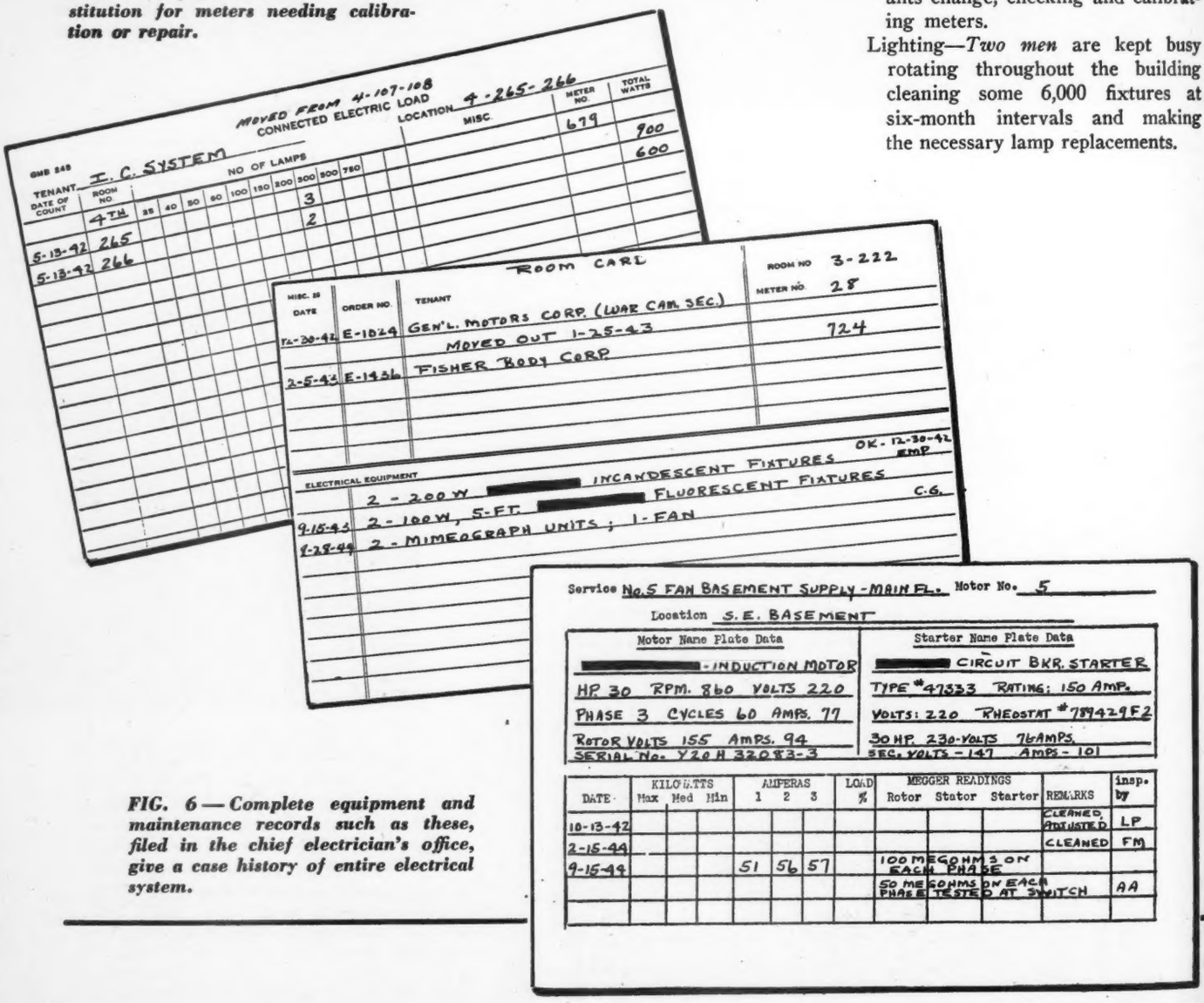
To operate more efficiently, the electrical maintenance crew is divided into the following groups:

Shop—*One man* to take care of the shop work that comes in from time to time. During the summer 90 percent of his work is repairing electric fans. Major equipment repairs are given to outside service shops.

Low Tension System—*One man* is permanently on maintenance of the 100-line PAX telephone system; impulse electric clock system (1000 clock capacity)—many being replaced with synchronous units; fire alarm, watchman's call, sprinkler alarm, and buzzer systems.

Meter Work—*One man* permanently on this work takes care of meter reading, shifting meters when tenants change, checking and calibrating meters.

Lighting—*Two men* are kept busy rotating throughout the building cleaning some 6,000 fixtures at six-month intervals and making the necessary lamp replacements.



MOVED FROM 4-107-108 — CONNECTED ELECTRIC LOAD — LOCATION 4-265-266

TENANT	DATE OF COUNT	ROOM NO	NO OF LAMPS 25	40	50	60	100	150	200	300	500	750	MISC.	METER NO.	TOTAL WATTS
I. C. SYSTEM		4TH								3				679	900
	5-13-42	265								2					600
	5-13-42	266													

ROOM CARL — ROOM NO 3-222 — METER NO. 28

MISC. ID DATE	ORDER NO.	TENANT	
12-30-42	E-1824	GEN'L. MOTORS CORP. (WAR CAM. SEC.) MOVED OUT 1-25-43	724
2-5-43	E-1956	FISHER BODY CORP	

ELECTRICAL EQUIPMENT — OK. 12-30-42 EMP

	2 - 200 W [redacted] INCANDESCENT FIXTURES
9-15-43	2 - 100 W, 5-FT [redacted] FLUORESCENT FIXTURES C.G.
1-28-44	2 - MIMEOGRAPH UNITS ; 1 - FAN

Service No. 5 FAN BASEMENT SUPPLY - MAIN FL. — Motor No. 5

Location S.E. BASEMENT

Motor Name Plate Data	Starter Name Plate Data
[redacted] - INDUCTION MOTOR	[redacted] CIRCUIT BKR. STARTER
HP 30 RPM. 860 VOLTS 220	TYPE #47333 RATING: 150 AMP.
PHASE 3 CYCLES 60 AMPS. 77	VOLTS: 220 RHEOSTAT #789429F2
ROTOR VOLTS 155 AMPS. 94	30 HP. 230-VOLTS 76 AMPS.
SERIAL No. Y20H32083-3	SEC. VOLTS - 147 AMPS - 101

DATE	KILOWATTS Max	Med	Min	AMPERAS 1	2	3	LOAD %	MEGGER READINGS Rotor	Stator	Starter	REMARKS	insp. by
10-13-42											CLEANED, ADJUSTED	LP
2-15-44											CLEANED	FM
9-15-44				51	56	57		100 MEGOHMS ON EACH PHASE				
								50 MEGOHMS ON EACH PHASE TESTED AT SWITCH				AA

FIG. 6 — Complete equipment and maintenance records such as these, filed in the chief electrician's office, give a case history of entire electrical system.

Motors—*One man* is permanently assigned to motor inspection—cleaning, oiling and making annual insulation tests on about 2,000 motors ranging from fractional up to 500 hp. in size (majority fractionals). He is responsible for keeping motor data card file up-to-date.

Night Shift—*Two men* are on night work answering calls for vacuum cleaners, floor scrubbing and polishing units and other work that cannot be done during office hours.

Alteration Work—*Four men* comprise the crew that does all alteration work that may be necessary due to office expansion, tenant shifts and moves. Major construction work is awarded to contractors.

Calls for the electrical maintenance department average 120 per day. Under normal conditions a service call is answered in about 15 minutes, although longer time may elapse if the shop is exceptionally busy when the request comes in. In any event, urgent or rush calls are first on the docket.

Service calls and alteration work are only part of the electrical maintenance department responsibility. A systematic preventive maintenance program is the foundation on which trouble-free electric service is built. Carefully compiled records (Fig. 6) are kept of the complete electrical system. A data card is filed for every transformer, feeder, motor or other piece of major electrical equipment in the building. On this is recorded the nameplate data and maintenance and repair record. Each feeder in the building is checked for load and voltage drop twice a year—on the darkest days with heaviest load. Accurate records of electrical equipment and connected load in each room of the building is kept on file. A case history of each electric meter is the responsibility of the meter man. All electrical system and equipment records are under the personal supervision of Chief Schusler and are kept in his office. By consulting his file data he can, in a matter of minutes, give the complete case history of any integral part of the building electrical system. By thus keeping his fingers on the pulse of the system he can anticipate trouble and take the necessary steps to prevent a breakdown in electric service to tenant.

From the foregoing, it is evident that electrical maintenance is taken seriously at the G. M. Office Building. Management acknowledges its responsibility in this respect and knows that a satisfied tenant is the best advertisement. Hence the maintenance of a well organized electrical department. Although this is a large building with a correspondingly large maintenance problem, the organization and operating technique employed is applicable to smaller buildings. There should be no difficulty in scaling down such a set-up to fit the maintenance problem in almost any building. The salient factors to remember are: There should be organized preventive and repair maintenance; also a complete set of records covering the entire electrical system. With this a reality, electrical trouble will diminish.

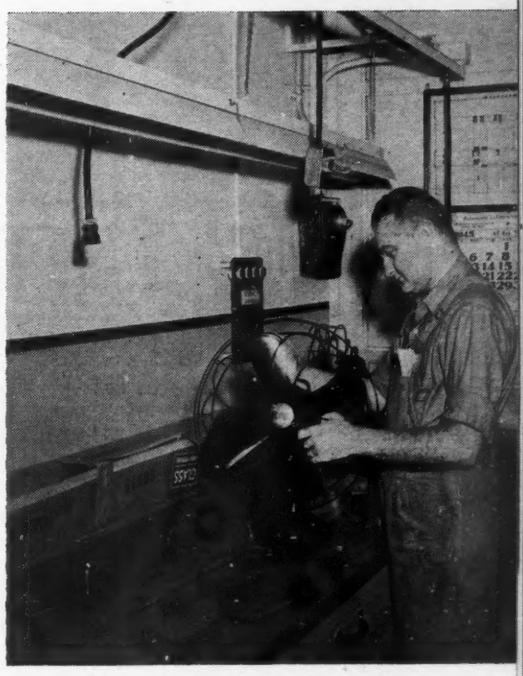


FIG. 7—Shop man is kept busy with small repair shop jobs. Note continuous fluorescent lighting and trolley duct convenience and test outlets.

FISHER 1 139
U.S.A. ZM 12-38

TRANSFORMER DATA

Make [redacted] KVA 150 Prim. V 4600 Sec. V 230/115 Ser. No. 702492
60 Cycles, Gal. oil 162 Style No. Spec. No. 7439 Type
P. O. No. Model No. Phase 1
Date 4-20-43 Equip. No. E
Impedance 3.93 % At °C Core Loss Copper Loss °C Rise
Polarity
Plant No. No. 3 TRANS. - "A" BANK - Rm. No. 3

LOCATION OF TRANSFORMER	DATE	OIL FILTERED DATE	REMARKS
MOVED TO TRANS. RM. No. 2	5-25-43		
DISCONNECTED	9-30-44	10-15-44	PUT ON WITH No. 2 - "B" BANK
INSTALLED No. 3 EAST TR. RM. 3	10-21-44		CORE PULLED, LEADS TAPED
			TESTED OIL - 11/24/44 - AVG. 28,677-VOLT BREAKDOWN

GMB 174
PRINTED U. S. A. 900 3-41

ELECTRIC METER RECORD

G M B C METER NO 140 MAKE [redacted] TYPE H SER NO 1873648
VOLTS 110 AMPS 5 PHASE SINGLE WATT HOURS PER DISC REV. 5/24 CONSTANT

USER	ROOM NO	DATE INSTALLED	ORDER	READING K W H	METER LOCATION	PANEL	DATE REMOVED	REASON	ORDER	READING K W H.
MODERN HOUSE, DIV	8-150	2-19-43		2711	8TH FL.	A	10-3-43	MOVED		3249
GEN. MOTORS CORP.	8-150	10-20-43		3257	" "	A	2-10-45	"		3863
FISHER BODY CORP.	8-150	2-10-45		3863	" "	A				

METER TESTED WITH STANDARD						CONNECTED LOAD CHECK			
DATE	% ERROR AS FOUND		% ERROR AS LEFT		TEST BY	DATE	WATTS		CHECK BY
	FAST	SLOW	FAST	SLOW			LIGHT	POWER	
3-3-38		99%	100%		RLM	2-17-43	400		VMF
12-29-43		100%	100%		RLM	10-20-43	400		EG
						2-10-45	1000		RLM

CALL PLAZA 2300
For Contractor Service

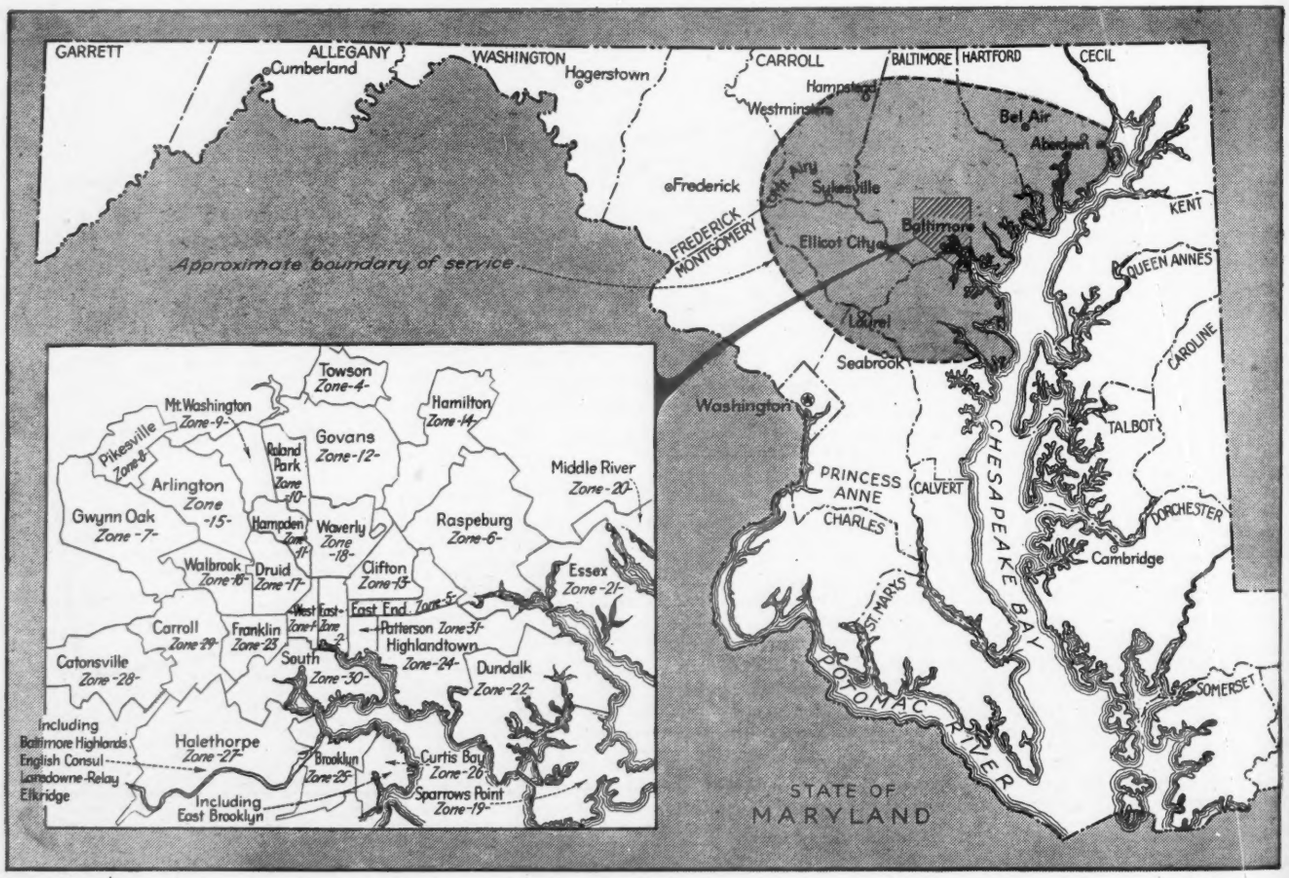
Prompt electrical service is assured all Baltimoreans 24 hours a day through "Electrical Contractors' Exchange", a telephone answering service.

WHAT do folks usually do when something electrical goes wrong? If the wiring fails, the lights go out, the refrigerator flunks, or the furnace motor stalls, they may know who to call—but usually don't. In Baltimore it's easy. Chances are they telephone PLAZA 2300.

The "Baltimore Electrical Contractors' Exchange," telephone PLAZA 2300, is an impartial telephone answering service. Established nearly two years ago, it is sponsored by the Electrical Contractors Association of Maryland, Inc. It is open 24 hours a day, including Sundays and holidays. Skilled operators man the switchboards to assist the homeowner, commercial establishment, industrial plant, or marine customer, in quickly locating a reputable and qualified electrical contractor for the type of work involved.

Before the Exchange was established, it was apparent to Charles H. Stark, president of the Association, that there was a need and demand for high grade, prompt and efficient electrical service. Users of electricity needed an easy way to locate qualified electrical contractors in their own neighborhood. This was true for new work, as well as for emergency repair and maintenance work. The demand was from war plants, striving for maximum production; from homeowners struggling with new servants or doing their own housework, and unable to purchase new appliances; and from commercial establishments, such as stores, offices, theaters, and places of

Fig. 1—Postal zones in Baltimore, and communities outside Baltimore, serve as area breakdown for operation of Baltimore Electrical Contractors' Exchange, an impartial telephone answering service.



Specially trained operators with Telephone Answering Service, an independent organization, receive telephone calls from customers desiring electrical contracting service.

Charles H. Stark, President, Electrical Contractors Association of Maryland, Inc., conceived the Baltimore Electrical Contractors' Exchange idea, and sponsored it with the Association.

recreation, unable to obtain priorities for new equipment, and working old equipment overtime.

Mr. Stark also knew that the contractors in the Association which he headed had the organization, management, skilled labor and technical "know-how" necessary to handle the work for which this unprecedented demand existed. Association members were already doing about 95 percent of the industrial work, and more than 85 percent of the commercial and domestic work. Yet surveys indicated that at least 400 calls per month were being made by the public, looking for the services of electrical contractors, mostly on the basis of service calls. The problem was to make it easy for the bewildered prospective customer to locate a reputable and qualified electrical contractor in his own community who was able to render the type of electrical service required.

An impartial telephone answering service, with skilled operators trained to handle telephone calls for electrical work efficiently and promptly, seemed to offer an ideal solution to this problem. A plan was worked out, based on this type of service, and presented to the membership of the Association. The Association promptly adopted the plan, thus establishing the "Baltimore Electrical Contractors' Exchange." It is believed to be the first of its kind.

Organization

The Exchange covers Baltimore City, and extends into surrounding counties over a radius of approximately 25 miles. The city is divided into areas which follow the standard postal zones. Areas outside the city are established on the basis of communities (Fig. 1).

Membership in the exchange is available to electrical contractors who are full members of the Association, and in good standing. In joining the exchange, each contractor obligates himself to render prompt and efficient service, and to adjust promptly and satisfactorily any complaints received by the exchange about work done by him (Fig. 3). Failure to abide by this agreement may be considered by the Association as justification for cancellation of membership in the Exchange.

Operation

The Electrical Contractors Association of Maryland, Inc., assumes all responsibility for the operation and management of the Exchange organization. It contracts with Telephone Answering Service, a private commercial organization, for the Exchange service. Exchange members pay the Association a small annual fee for privileges of membership.

The Association actively solicits new

ADVANTAGES TO PUBLIC

1. Prompt electrical service, including emergency work.
2. Reputable electrical contractors are assured.
3. Prevailing charges on file with OPA are used.
4. An electrical contractor in customer's own neighborhood serves him.
5. Electrical Contractors Association of Maryland, Inc. guarantees satisfactory service.
6. Electrical service available 24 hours a day, including holidays.

ADVANTAGES TO MEMBERS

1. Customers are located in the contractors' own neighborhood.
2. Customer good-will created through prompt service.
3. Contractor is identified with the Electrical Contractors Association of Maryland, Inc.
4. Customer confidence established in contractor's work.
5. Increased sales.
6. Industry good-will created.
7. Saves time.

Managing the Electrical Contractors' Exchange is one of the duties of Jesse J. Brian, General Manager, Electrical Contractors Association of Maryland, Inc.

Spot Program

Radio Station WITH

10:29 A. M. Daily

We don't think much about electric lights or wiring until something goes wrong, then it's a matter of great importance, in fact, even dangerous if not attended to. Yes—you've had trouble locating or obtaining a reputable Electrical Contractor, we know, but those days are gone forever. All you have to do now is call the Electrical Contractors Telephone Exchange. It's Plaza 2300. The next time you're in need of electric wiring or repairs, call Plaza 2300 and they will immediately put you in touch with a reputable contractor in your neighborhood. Each contractor's charges approved by O. P. A. Have you got that number? Write it down. The Electrical Contractors Telephone Exchange, Plaza 2300.

Fig. 2—A daily spot commercial, over radio station WITH tells the public about the Electrical Contractors Exchange. This commercial doubled the number of customer calls per month.

members. Electrical contractors who are non-Association members may join the Exchange by first joining the Association.

Exchange publicity and advertising is handled by the Association. An appropriate listing is made in the telephone directory. Newspaper advertisements are used regularly. Beginning in October, 1945, a contract was made with Baltimore's radio station WITH for a daily spot commercial 10:29 A. M. (Fig. 2). The Association's general manager, Jesse J. Brian, states that customer calls

[Continued on page 190]

February 14, 1944

Electrical Contractors Association of Md.,
405 Munsey Building,
Baltimore - 2, Maryland.

Gentlemen:

Being a full member of the Association in good standing, I wish to participate in the benefits of the Electrical Contractors Exchange. Please find enclosed herewith one year assessment in the amount of $15.00, which I understand will be assessed each year for this service.

I/we have proper facilities to render electrical service in the following branches of work:

Domestic.....
Commercial.....
Industrial.....
Marine.....

I/we will be available:

Days.....
Nights.....
Holidays.....

Please see that the public is directed to me/us for the work as checked above. I/we agree to render prompt and efficient service and do work in accordance with established laws and rules.

I/we also agree to adjust promptly and satisfactorily any complaints that the Electrical Contractors Exchange receives about me/us.

.....
Company Name

.....
Signature

.....
Address

.....
Mailing District

.....
Day Telephone Number

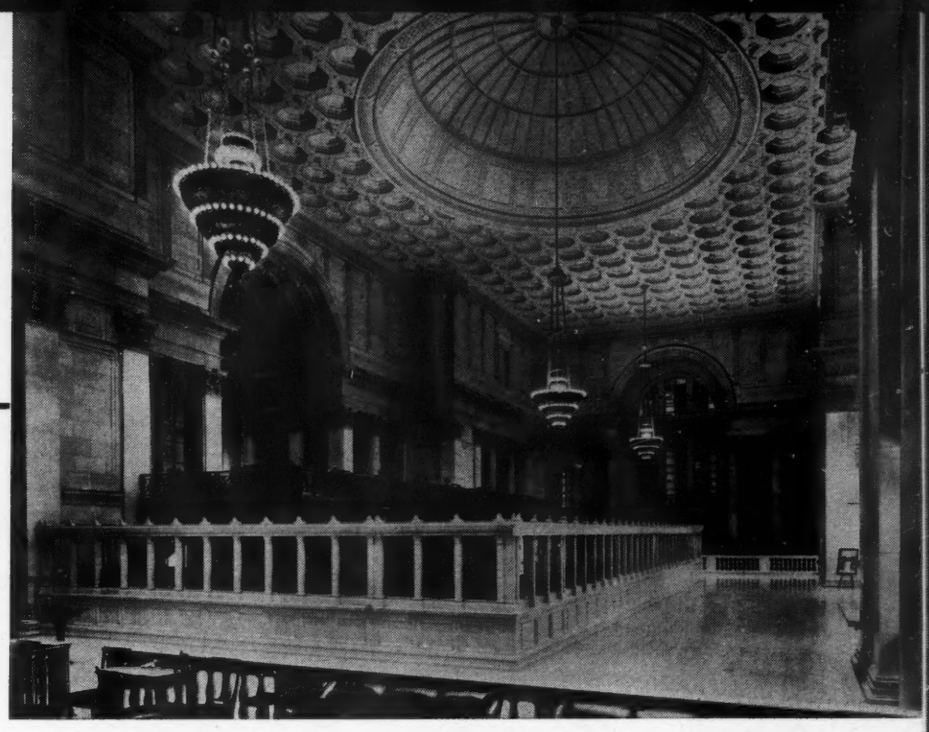
.....
Night Telephone Number

Fig. 3—Exchange members sign the above agreement with the Electrical Contractors Association.

CALL FOR Electrical Contractor
NAME Zone (8)
ADDRESS Lawrence Orson APT. No.
PHONE No.
REMARKS
3017 Guilford Ave
Zone 18

PHONE - NO MESSAGE | | PLEASE CALL HIM
WILL CALL AGAIN | | RECEIVED BY S FROM

Fig. 4—This simple form is used by the telephone operator for recording calls as they are received. The contractor's name and zone number is placed on the back of this form, which is given to the Association at the end of the month.



National City Bank, New York City, used concealed "downlights" to project light through openings in ceiling coffers, reflector floodlamps in luminaires for indirect lighting, and small wattage lamps in luminaires to modernize the lighting. The layout was engineered by Rambusch Decorating Company for Aaron Alexander, Architect.

Light is used for architectural and decorative treatment of bank buildings as well as for illumination of work areas, for advertising, and for protection.

BANK LIGHTING TECHNIQUES

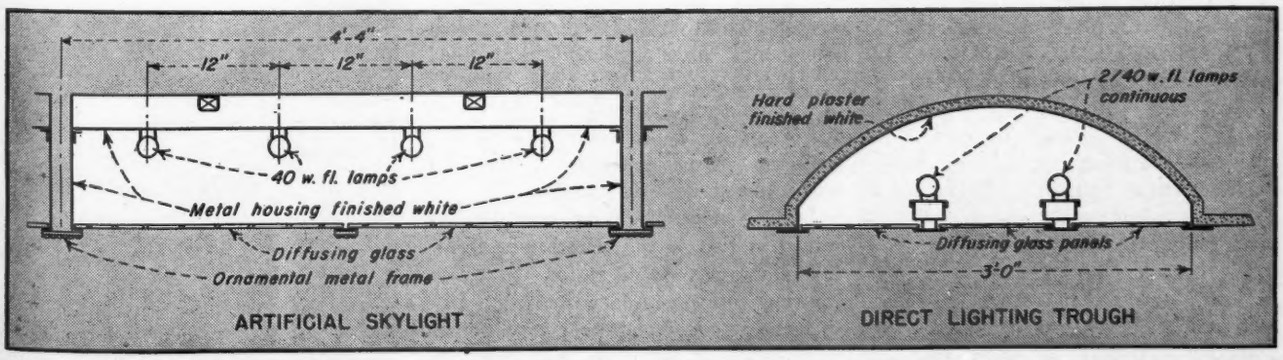
By Berlon C. Cooper

THE bank is more than a building. It is an institution. It is the financial center of a community. It is important, therefore, that the building impress customers and prospective clients with the solidity, trust and confidence of the bank as an institution. Through its architecture, furnishings, and physical appearance, the building must create an atmosphere of conservatism, dignity and refinement. Light, properly planned and applied, is a valuable adjunct to stone and steel in achieving this desired result.

Until recently, bank architecture has created an impression of a fortress. Within the last 20 years, however, it has undergone considerable change. The new trend is toward simplicity in design, with enough architectural detail to relieve the severity of plain, unbroken wall surfaces. Greater use is being made of glass, in window areas and in block wall areas. Natural skylights are being discarded in favor of artificial skylights, or of large luminous areas of low brightness where architectural lighting elements form part of the architecture and decorations.

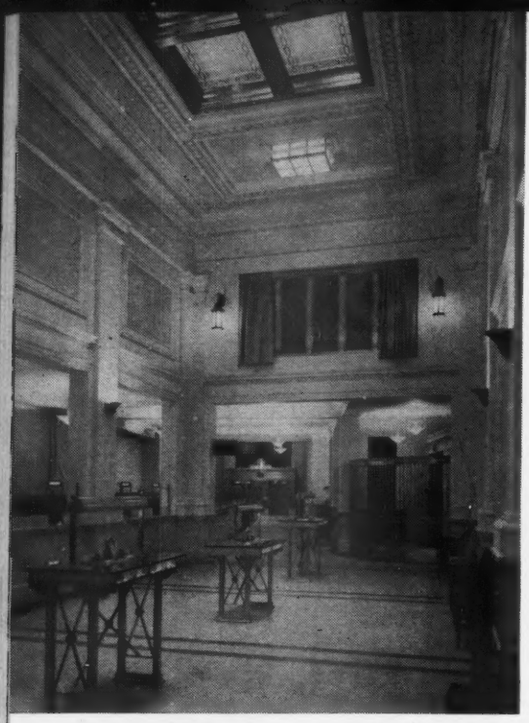
The bank embraces specialized functional areas and typical office areas. The main banking room is a specialized area designed to serve the public effectively. It should be so located in the building as to be readily accessible from the outside of the building for the convenience of its customers and the public. It should also be readily reached by all employees. Other typical areas in a bank include the board room, conference rooms, private and general offices, vaults, and service areas.

The physical layout for main banking rooms follow three basic plans generally. These are commonly recognized as the horse shoe, or U plan, the island layout, and the half island plan. These layouts involve the arrangement of counters, or cages, which are used to separate bank employees from the public and to provide protection. Each plan has its own advantages of efficiency and operation. The size and shape of the build-



Uniformly lighted diffusing panels installed flush in ceiling below daylight fluorescent lamps in metal housing forms artificial skylight.

Low brightness luminous panels can be formed into artistic ceiling patterns to produce uniform lighting and decorative effects.



Combination of skylight, Holophane lens unit on ceiling, indirect wall urns, semi-indirect fixtures, ornamental lantern brackets, illuminated teller's windows, and ornamental check desk units are shown in this photo of the public area. Bloomfield Savings Institution, Bloomfield, N. J.

ing, however, often affects the selection of the plan for individual banks.

The lighting system selected for each bank area should harmonize with and form a part of the general architecture and decorative treatment of the bank. It should be used to accent architectural detail, and to enhance decorations. Above all, it should create a comfortable and attractive atmosphere, and provide a proper quantity and quality of illumination for each specific area of the bank.

Banks are usually housed in elaborate type buildings of classic style architecture. Light offers a medium for many advantageous applications. It can be used to provide comfortable working illumination for employees who now work longer hours in the bank, and for customers who patronize the bank during evening hours. It can be used for its advertising value, in floodlighting exterior architectural details, or in subtly lighting the main banking room during evening hours and made visible to passersby through larger window areas. It can be used to create an appropriate atmosphere, and to reveal artistic features of the building. It can also be used for its protection value, floodlighting exterior areas, interiors and vault entrances.

Main banking room—A general level of illumination ranging from 20 to 30 footcandles should be maintained in service in the main banking room, or public space, as it is sometimes designated. It may be direct, direct-indirect, or indirect. All light sources should be adequately shielded and concealed from the normal line of vision in any type system selected. The style of architecture and type of decorative treatment will guide to considerable extent the type of lighting system which is appropriate for each bank.

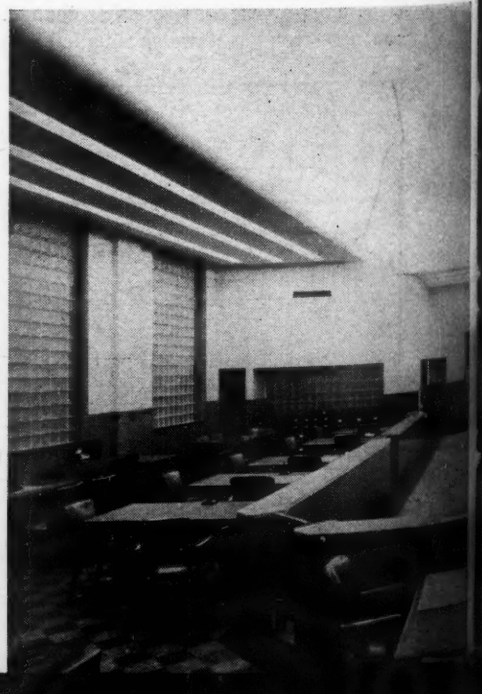
Appropriate direct lighting may be obtained from a number of types of lighting equipment. Large luminous panels of low surface brightness installed in the ceiling offer an ideal direct lighting method, high in efficiency, and effective in providing proper diffusion and color quality of the resultant illumination. Continuous line fluorescent troffers, recessed flush in the ceiling, and shielded either by louvers or glass plates, produce adequate lighting and make a neat installation. Individual units, either fluorescent or incandescent, installed flush in the ceiling, are also applicable. These units may be shielded by louvers or glass lens plates, or may be of the typical "downlight" type, where the shape of the reflector is such that reflections from the side of the unit are softened, or eliminated.

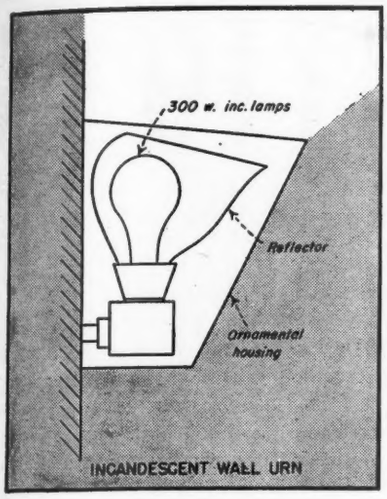
Direct-indirect lighting may be obtained in two ways. Direct type lighting units may be used for the direct lighting component, and indirect lighting may come from other type equipment, such as pedestals, wall urns, or cove lighting. Individual lighting units may also incorporate both features of direct and indirect lighting, but of necessity are pendant type units. This system offers the advantage of providing light on the ceiling to soften the contrast between the ceiling and direct lighting type units. It also provides high level illumination efficiently from the direct lighting type units. Care must be exercised to maintain low brightness area on all direct lighting type units, if the proper lighting result, free from direct and reflected glare, is to be obtained.

Indirect lighting is particularly effective in creating a dignified atmosphere, and in accenting architectural detail. It may be considered less efficient in producing footcandles of illumination, but efficiency of a lighting system cannot be judged solely on illumination intensities. The artistic and decorative effect

Semi-direst continuous row fluorescent troughs harmonize with interior decorative treatment in this banking room.

Cove lighting is combined with continuous troffers in this Savings and Loan Association banking room. Fluor-



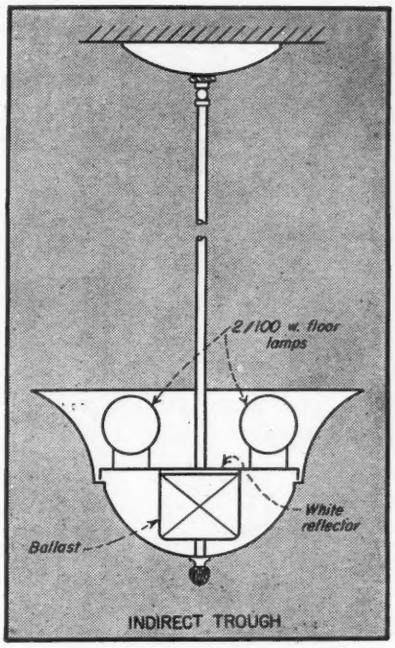


Urns installed on walls, columns or pilasters add decorative effect and conceal reflectors for indirect lighting.

is also important in any lighting system, and particularly in monumental type buildings, such as banks. Indirect lighting may be obtained from incandescent pedestals and wall urns, from suspended fluorescent troughs, and from cove lighting. Cove lighting may consist of lighting the entire ceiling from side coves, or may consist of lighted panels and soffits in the ceiling.

All comments above relate to general lighting for the banking room. Localized lighting is also important in this area. With the new style counters now coming into use in banks, teller's work areas can be lighted locally with fluorescent reflector units installed under the deal plate. Check desks should also be lighted locally, to provide an intensity higher than the general level of illumination. Ornamental units and fluorescent lamps are ideally suited as a light source.

escent lamps are used throughout. Intensity is 30 footcandles in public space, and 45 footcandles in work area.



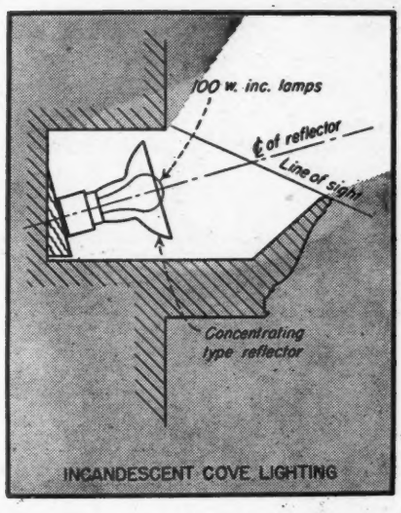
Small banks with low ceilings are effectively lighted with fluorescent opaque or luminous indirect lighting troughs.

Vaults—Bank vaults present a problem of providing sufficient vertical and horizontal illumination to permit identity of safe deposit boxes easily, and for casual inspection of their contents. It is also important to minimize glare from specular surfaces of the boxes. Ceiling heights are usually low, and aisles are narrow. Continuous row fluorescent troughs equipped with diffusing glass sides and bottom offer an ideal solution to this problem. Typical aisle lighting units, or corridor units, may also be used, but produce less uniform lighting results.

Board Room—The board room offers the architect an opportunity for expressing individuality in architectural and decorative treatment. Lighting equipment should be adequately shielded, or concealed, and an intensity of 25 footcandles or more is desirable. Cove and coffer lighting are especially appropriate for this area.

Private Offices—Indirect or semi-indirect lighting, and preferably with flexibility provided for two intensities, is appropriate for private offices. Lighting should be uniform throughout the office area, to permit desks and conference tables to be placed where desired, without reference to location of the lighting equipment. A minimum intensity of 25 footcandles is desirable.

General Offices—Indirect or semi-indirect lighting is desirable in the general office area. Recessed shielded fluorescent troffers, spaced close enough



Wall coves are kept small by recessing reflectors behind wall line. Concentrated reflectors light ceiling uniformly in wide areas.

to provide uniform lighting, is also appropriate. From 40 to 50 footcandles is required for seeing, and for preventing errors. (Office lighting was covered fully in "Office Lighting Techniques" in the May, 1945 issue of *Electrical Contracting*).

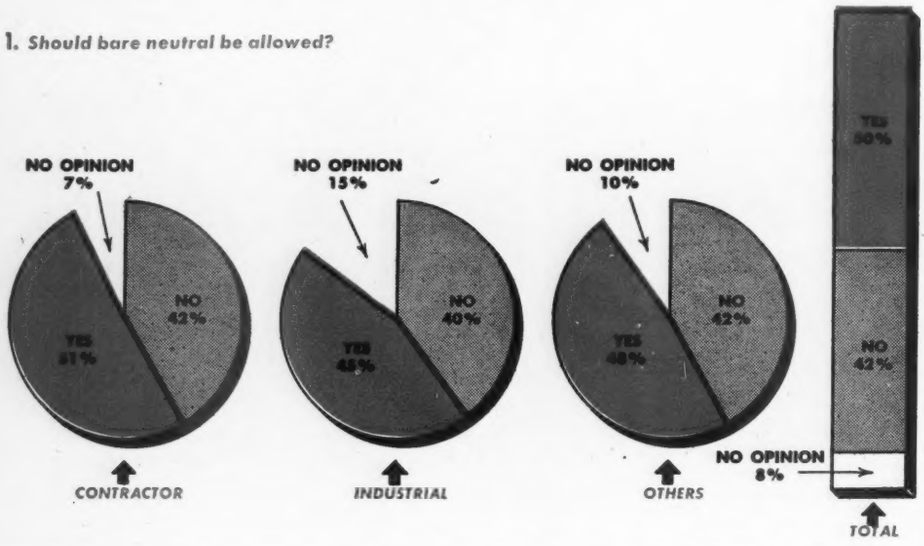
Exterior—Floodlighting of the exterior of a bank building, has the advantage of making the building an object of beauty at night as well as by day. Plain fronts can be floodlighted best from across the street, or from combination street lighting standards and floodlights. Where the building incorporates architectural details, floodlights mounted on the building to accentuate these details are effective.

Entrance—Ornamental lighting units are appropriate for entrances. They should create a cheerful and inviting appearance.

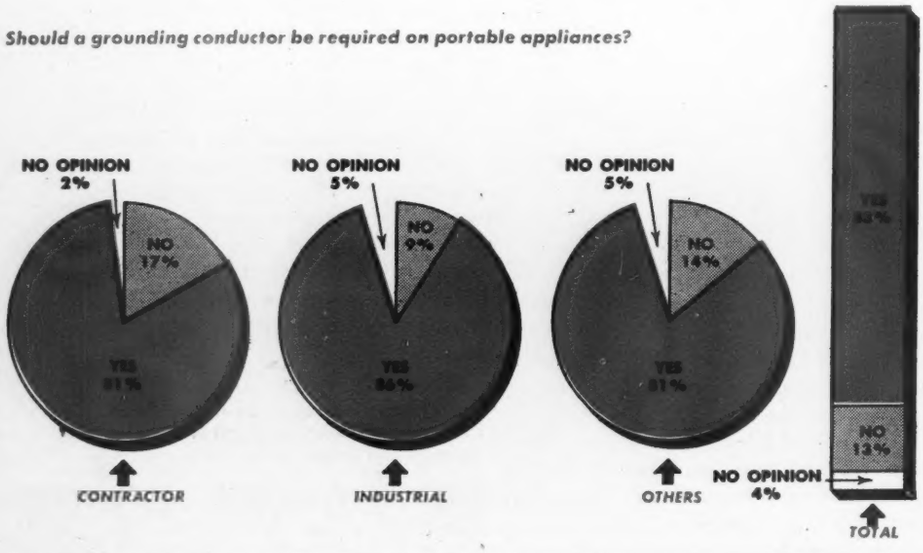
Fluorescent lamps installed under deal plate provides high level local lighting for bank tellers and cashiers.

SIX QUESTIONS.

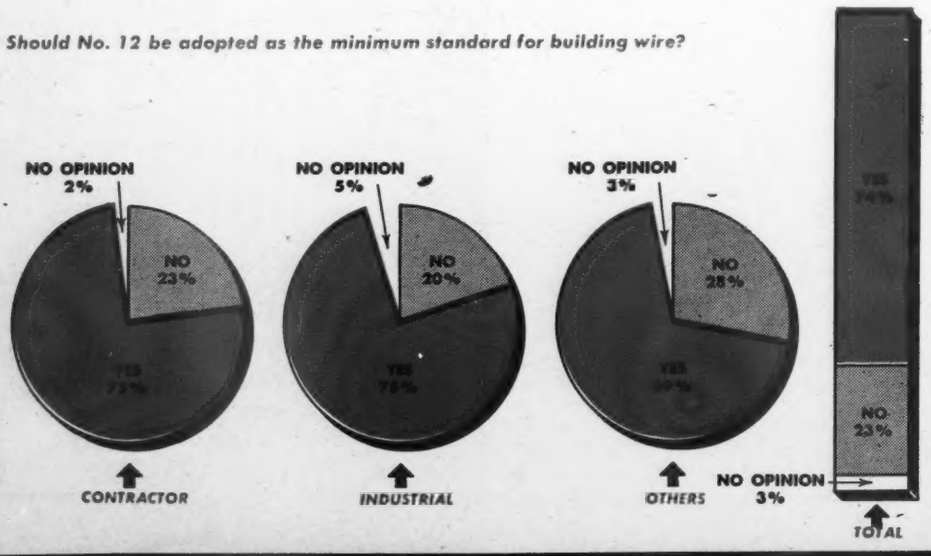
1. *Should bare neutral be allowed?*



2. *Should a grounding conductor be required on portable appliances?*



3. *Should No. 12 be adopted as the minimum standard for building wire?*



THROUGH the well known statistical method of random sampling, *Electrical Contracting* is measuring reader reaction to controversial issues. In this article we have assembled the weight of opinion pro and con on six questions, all pertaining to industry problems before us today.

The first three of these questions concern wiring methods, the last three, industry policy. The questions were directed to electrical contractors, industrial plant electrical men, electrical inspectors, motor shops, utilities, engineers and others on a random selection from the subscription lists. Replies were tabulated in three groups, electrical contractors, including all those identified with electrical contracting firms, industrial chief electricians, including all those identified with industrial installation and maintenance, and all others.

The size of the sample for the first three questions was approximately eight times larger than that for the last three. However, the percentages drawn from any one of the eight mailings on the first group varied less than three percentage points from the total. Since the three last questions concerned policy and the results were not critically close, the additional accuracy of a larger sample was considered unnecessary.

QUESTION 1—Should bare neutral be allowed?

This proved to be the most closely contested issue of the series. *Yes* says 50 percent. *No* says 42 percent. And 8 percent expressed *no opinion.* A good number of the replies were qualified by written in comments, mostly from those who replied in the affirmative.

QUESTION 2—Should a grounding conductor be required on portable appliances?

Here the weight of opinion leans overwhelmingly toward the affirmative with 83 percent *for,* 13 percent *against* and 4 percent expressing *no opinion* one way or the other. *Industrials* showed a significantly stronger affirmative than

S. . . . ?

Opinion poll of *Electrical Contracting* readers shows well defined attitudes shaping up on controversial issues.

contractors or *others* with 86 percent *for* and only 9 *against*, such grounding practice.

QUESTION 3—Should No. 12 be adopted as the minimum standard for building wire?

A clear affirmative is given by 74 percent of the total. 23 percent say *no* and 3 percent *no opinion*. A number of qualifying comments urged larger terminal screws on wiring devices and more room in boxes.

QUESTION 4—Should management be allowed to contract for industrial wiring or perform work with their own crews without interference from union jurisdictional claims?

Most complicated problems of labor relations are those involving jurisdictional claims. Opinions of readers are definitely toward giving management its say on how and by whom work shall be done without interference from union claims. 63 percent say *yes*, 21 percent say no, and 16 percent express *no opinion*.

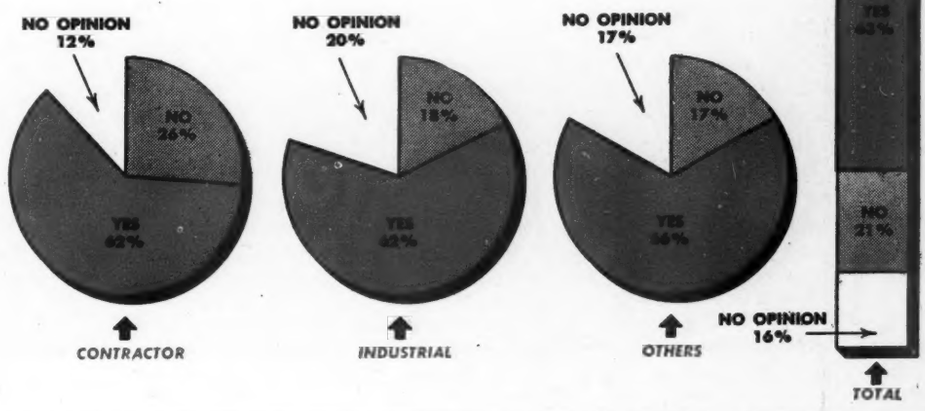
QUESTION 5—Should electrical contractors and chief electricians be licensed under state laws?

Most want licensing. 79 percent said *yes*, 17 percent *no*, and 4 percent *no opinion*. *Contractors* and *industrials* share about the same weight of opinion indicating that the desire for licensing is based upon protection of technical standards.

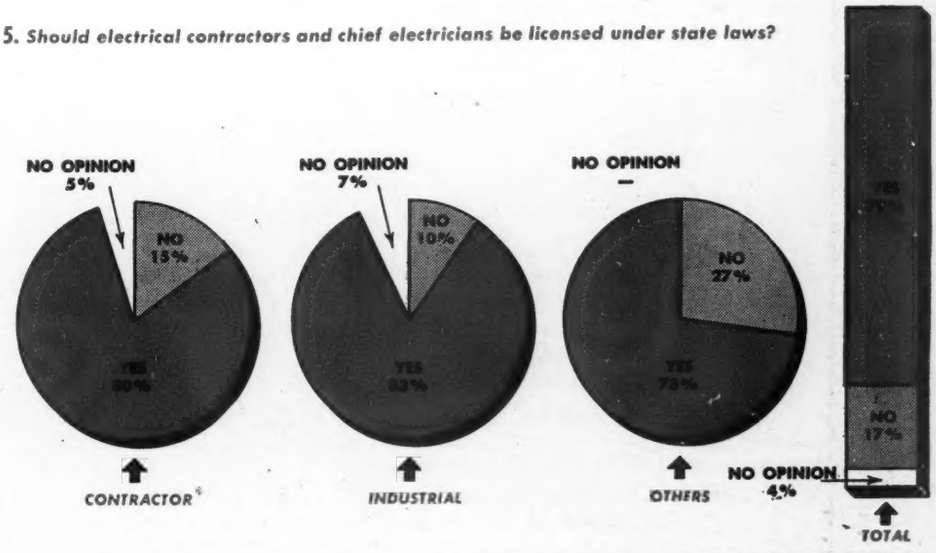
QUESTION 6—Should current hourly rates for electricians be increased to bring weekly wages in line with wartime pay?

Since most readers of *Electrical Contracting* are at the management level, the response would be necessarily weighted that way. However, the results came out 48 percent *yes* and 35 percent *no* with 17 percent expressing *no opinion*.

4. *Should management be allowed to contract for industrial wiring or perform work with their crews without interference from union jurisdictional claims?*



5. *Should electrical contractors and chief electricians be licensed under state laws?*



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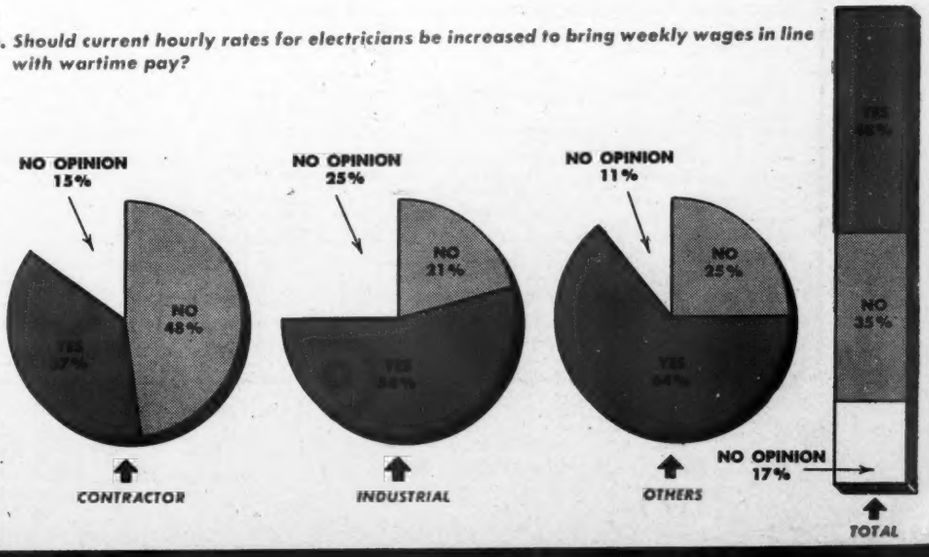


How Much Will It Cost.....

The answer to an estimator's prayer for an accurate unit cost guide for preliminary field estimating of industrial lighting branch circuit wiring. Outlet units are based on simple branch circuits with conventional panel switch control.

"HOW much will it cost to install the wiring for the lighting in my plant?" The owners ask the question and expect to get a price which will cover the cost of the *complete* job. Such a price will have to embrace many items of expense not indicated in a preliminary drawing. Shifting outlets (after installed), routing conduit around skylights or equipment, or any other extra work which ordinarily arises on industrial jobs, has to be covered in a preliminary estimate. Besides, the owner assumes that the work is to be figured in accordance with the best engineering and construction practices.

The purpose of these introductory remarks is to emphasize and impress on the reader's mind that the units (lighting branch wiring) for general application as preliminary estimating guides, are entirely different from those applicable to a single isolated case, where job and labor conditions are reasonably well established.

Chances are that the first reaction of most of us will be that the units in the accompanying table are high. There are several reasons for expecting this. Among them are:

1. As estimators, *we are in the habit of checking base costs*—the prices with which we are most familiar.
2. *The cost of labor is much greater than that for material.* With the proper mark-ups (the greater burden on labor), the spread between base cost and selling price is considerably wider than it is for other branches of the work.
3. We visualize ideal working conditions which may not exist.
4. It is hard to reconcile labor costs because we are inclined to think only of the labor required after all preliminary preparations are completed.
5. Cost of home runs, allowances to prevent excessive voltage drop, supervision, inspection, shrinkage, and incidentals are *all items of expense which do not enter into our mental calculations.*

There may be a little so-called "cushion" in the units, but we know from experience that when it comes to installing the work, there will be plenty of changes come up to readily absorb such a reserve. "You can't have that because it wasn't included in my estimate" is not the best thing to be repeatedly saying to a customer.

It is important that emphasis be

PRICING SHEET — DATE Nov. 20 1945

JOB OR BLDG. BRANCH LIGHTING UNITS — LOCATION

BID TO 300-WATT OUTLETS ON 12-FT — ADDRESS

ARCHT. OR ENGR. FLAT CONCRETE CEILING — ADDRESS LABOR RATE - $1.70 per hr.

PLANS MARKED 12' x 12' SPACING — SCALE — SPEC. No. — EST. No.

EST. BY — PRICED BY — EXTENSIONS BY — CHECKED BY — S.O. No. — SHEET No. 1

MATERIAL	QUANTITY	MATERIAL UNIT	EXTENSION	LABOR UNITS	EXTENSION
DEVELOPMENT OF COST UNITS					
UNIT I - BASE UNIT					
4" OCT. BOX	16	11	176	80	12.80
½" CONDUIT - RIGID GALV.	110'	6.00 C'	660	.12	13.20
¾" " " "	135'	7.70 C'	1046	.13	17.55
No. 12 R.C. WIRE	260'	9.50 M'	2.48	1200 M'	3.15
No. 10 R.C. WIRE	340'	14.20 M'	4.85	150 M'	5.10
EXPANSION SHIELDS & STRAPS	42	.05	2.10	.20	8.40
			$28.19		$60.20
INCIDENTALS		3%	.85	3%	1.80
INSPECTION (PERMIT)	4 CIRCUITS		2.80		—
			31.84		62.00
MARK-UPS (INCL. INSURANCE)		10%	3.18	52%	52.25
TOTAL FOR 16 OUTLETS			$35.02		$94.25
EST. SELLING UNIT PER OUTLET		MAT. →	2.19	LAB. →	5.88
$2.20 + $5.90 = $8.10 ←		USE	2.20	USE	5.90
ESTIMATED SELLING UNITS PER OUTLET					
UNIT I - ON FLAT CONCRETE CEILING - K.O. BOX			(2.20 + 5.90)	=	8.10 ←
UNIT II - " " " " - HUB FTG.			(8.10 + 1.00)	=	9.10 ←
UNIT III - " BEAM " " - HUB FTG.			(9.10 + 2.70)	=	11.80 ←
UNIT IV - ON WOOD - FLAT - K.O. BOX			(8.10 - 1.10)	=	7.00 ←
UNIT V - " " " - HUB FTG.			(7.00 + 1.00)	=	8.00 ←
UNIT VI - " " - BEAMS - " "			(8.00 + 2.70)	=	10.70 ←

LABOR MARK-UPS
14½% INS. + 5½% J&E COSTS = 20%
GEN. O.H. = 15% RETURN = 10%
1.00 + 20% + 15% + 10% = 1.52

NOTE: DERIVATION OF UNITS II to VI SHOWN ON SHEET 1-A

FIG. 1—Typical estimate made to develop each unit cost figure listed in Table 1. Estimate is for wiring to 16 outlets; does not include panel. Development of units for various installation conditions shown in Fig. 2.

PART V

By Ray Ashley
Research Engineer
Electrical Contractors
Association of City of Chicago

placed on the labor ratio in this phase of electrical work. Justification of this lies in the fact that:

1. The labor ratio *is much higher than is ordinarily experienced* on complete installations.
2. Hazards of contracting are in proportion to the labor ratio.
3. Adjustment of the tables will be due principally to changes in labor rates.

Surveys show that the business of practically all contractors has a material-labor ratio of 60-40. That is, 60 percent of the base cost is chargeable to material and 40 percent to labor. In other words, the purchase price of the materials used is 50 percent more than the payroll for labor. *The reverse is true for the branch wiring portion of the work.*

The accompanying estimate (Fig. 1) shows a total base cost (for the 16 outlets) of $31.84 for the material and $62.00 for the labor, *the labor ratio being 66 percent* (62 ÷ 93.84). Other estimates used for establishing the table indicated a range of from 55 percent to 70 percent. For the purpose of discussion, an approximate average (for all estimates) of 60 percent can be used.

A contractor who experiences a 15 percent overhead on the normal run of "60–40" jobs would have to *use an overhead mark-up of 18.75 percent for the class of work having a "40–60" ratio.* To establish the job overhead for this latter ratio, one must revert back to the individual overhead items which produced the normal 15 percent overhead mark-up.

Based on studies made by the Electrical Contractors Association of City of Chicago, the specific overhead items that produce the 15 percent job overhead mark-up are: Material—7.5 percent; Labor—26.2 percent. This is developed as follows for the normal 60–40 job:

PRICING SHEET — DATE Nov. 20 1945

JOB OR BLDG. BRANCH LIGHTING UNITS — LOCATION
BID TO 300-WATT OUTLETS — ADDRESS
ARCHT. OR ENG'R. 12' x 12' SPACING — ADDRESS
PLANS MARKED — SCALE — SPEC. No. — EST. No.
EST. BY — PRICED BY — EXTENSIONS BY — CHECKED BY — S.O.No. — SHEET No. 1-A

MATERIAL	QUANTITY	MATERIAL UNIT	EXTENSION	LABOR UNIT	EXTENSION
CHANGES IN BASE UNIT FOR DIFFERENT MOUNTING CONDITIONS (SEE SHEET 1)					
UNIT II - HUB FITTING FOR BOX - FLAT CONCRETE CEILING					
ADD - MATERIAL - $0.60 + 10% =			0.66		
ADD - LABOR - $2.20 + 52% =			0.804		
ADD - TOTAL -			0.964		
USE $1.00					
SELL. UNIT = $8.10 (BASE UNIT) + $1.00 = $9.10					
UNIT III - HUB FITTING - BEAM CEILING - CONCRETE & BEAMS - 16 FITTINGS NEEDED					
½" FITTINGS & COVERS	8	.50	4.00	.60	4.80
¾" " " "	8	.65	5.20	.70	5.60
CONDUIT - ADDITIONAL	200'	.06½	1.46	.15	3.00
WIRE - "	500'	-	4.45	.02	1.00
ADD. COST OF PULLING WIRE	600 (TOTAL)		-	.01	6.00
			11.05		20.40
MARK-UPS		10%	1.10	62%	10.60
		MAT.	12.15		31.00
		LABOR	31.00		
TOTAL ADDED FOR 16 OUTLETS			43.15		
ADDED COST PER OUTLET			2.70		
TOTAL SELL. UNIT PER OUTLET = 8.10 (UNIT II) + 2.70 =			$10.80		
UNIT IV BASE UNIT ON FLAT WOOD CEILING					
DEDUCT FOR ANCHORS - MATL. 2.15 + 10% =			2.37		
LABOR 8.64 + 52% =			13.07		
TOTAL DEDUCTED FOR 16 OUTLETS			15.44		
DEDUCTION PER OUTLET			0.96		
DEDUCT FOR ANCHORS					0.96
= FAC BOX LABOR (8.64 + 52%)					-0.15
TOTAL DEDUCTION					$0.81
BASE UNIT ON FLAT WOOD CEILING = 8.10 - 1.10 =	$7.00		USE $1.10		

FIG. 2—Changes in base unit (Fig. 1) for different installation conditions were determined from above typical calculations. Units used in Table 1 are shown at bottom of Fig. 1 estimate.

(1) Material ..60/100× 7.5= 4.5
Labor ....40/100×26.2=10.48

Total 14.98
Use 15.00%

Applying these individual overhead percentages to the *40–60* job we find:

(2) Material.. 40/100× 7.5= 3.0
Labor .... 60/100×26.2=15.72

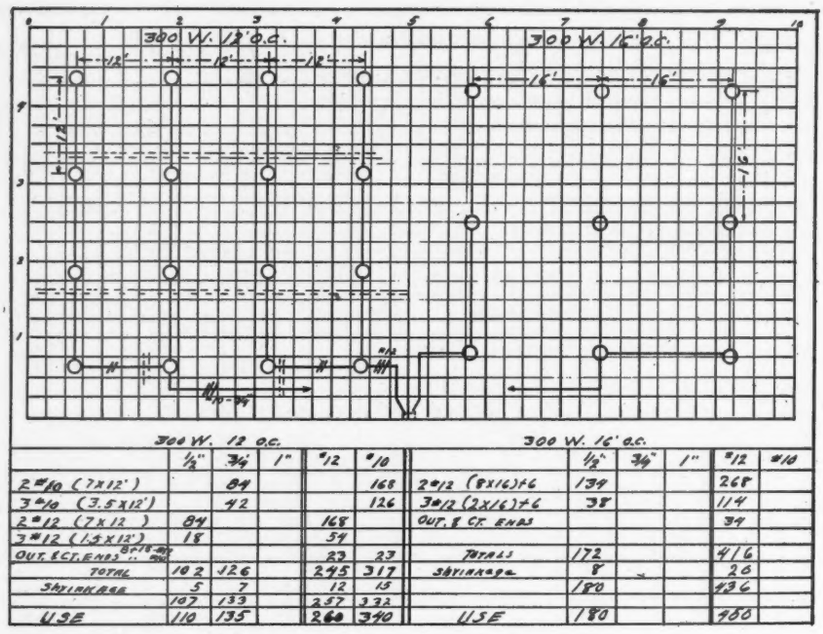
Total 18.72
Use 18.75%

Preparing the Units

Several completed installations were studied and costs (materials and labor for lighting branch wiring) set up on an outlet basis. These studies served both as a guide and a check for the estimates which were to follow. Also, as a preliminary step, a skeleton plan (Fig. 3) was prepared. Enough prints were made of this plan so that separate layouts could be made for the various wattages and spacings. A base estimate was prepared for each wattage with various spacings. This estimate was for the type of installation shown in the first column of Table I (Rigid steel conduit exposed on a 12-ft. flat concrete ceiling; four-inch octagon steel box—K. O. type; includes wiring installation from panel to outlets).

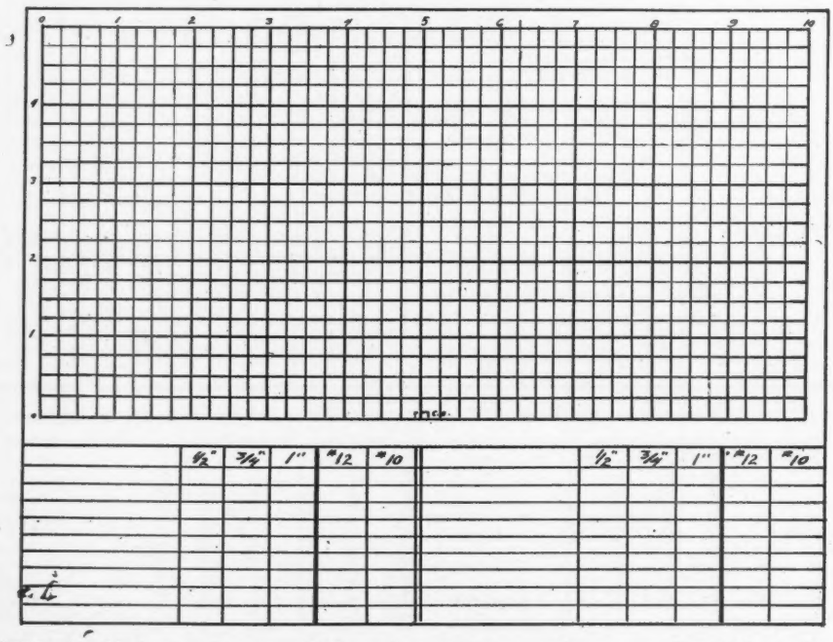
All other units for work exposed on wood and concrete were established by additions to or deductions from this base estimate. Amounts for additions or deductions were established by secondary estimates. (See Sheet 1-A, Fig. 2).

The conduit and wire measurements established for the base estimates were also used for the steel truss and messenger cable installations. Check estimates



	300 W. 12 o.c.						300 W. 16' o.c.					
	½"	¾"	1"	#12	#10		½"	¾"	1"	#12	#10
2-#10 (7x12')		84			168	2-#12 (8x16)+6	134			268	
3-#10 (3.5x12')		42			126	3-#12 (2x16)+6	38			114	
2-#12 (7x12')	84			168		Out. & Ct. ends				34	
3-#12 (1.5x12')	18			34							
Out. & Ct. ends 15% add				23	23	Totals	172			416	
Total	102	126		245	317	Shrinkage	8			26	
Shrinkage	5	7		12	15		180			436	
	107	133		257	332						
USE	110	135		260	340	USE	180			480	

FIG. 3—Sample layouts similar to this, on skeleton plans, were the basis of estimates made to arrive at unit cost figures in Table 1.



½"	¾"	1"	#12	#10		½"	¾"	1"	#12	#10

FIG. 4—Skeleton plan on which various outlet spacings were plotted for take-off and estimate of "cost per outlet" units shown in table.

were set up to establish multipliers which were used to adjust the base unit for concealed and exposed work on 16-ft. ceilings.

The Estimate

As shown by the sample layout and estimate, units are not based on minimum code requirements. *The wire is heavy enough to prevent excessive voltage drop and circuits are not loaded.* There are two reasons why preliminary estimates should not be based on loaded circuits. First: The final plans may provide panel switching with a limited number of lights per circuit; second, provisions should be made for the addition of occasional outlets.

The base labor units are intended to cover all prorata expense, such as supervision, preparation, lost time, etc. All inspection (permits), insurances, and job costs are included as shown in the sample estimate. The mark-ups used are as explained in previous articles.

The units in the table represent only a portion of the complete lighting installation—*the branch circuit wiring.* To this must be added the cost (contractor's selling price) for service and feeders (E.C., Nov., 1945, pg. 52); main distribution panels (E.C., Dec., 1945, pg. 64); lighting panels; supply and installation of the fixtures; and any specialized control installation that may be specified.

A study of the table reveals that its cost units cover various outlet wattages at conventional spacings; incandescent and fluorescent installations; and various installation conditions. After the estimator determines the type of building construction; ceiling heights; wattage, spacing and total number of outlets, he merely refers to the table and uses the proper "cost per outlet" unit to arrive at his preliminary estimate of the branch circuit wiring.

Example:

Problem—Prepare a preliminary estimate of the installation cost of lighting branch circuit wiring for a 200-ft. by 50-ft. industrial plant area with a 12-ft. flat concrete ceiling. Exposed conduit circuits to feed hub-fitting, 150-watt outlets (for 3-lamp, 40-watt, fluorescent RLM units) on 10-ft. by 10-ft. spacing. Total outlets—95.

Solution—The cost per 150-watt outlet with hub fitting on 10-ft. by 10-ft. spacing (See Table 1, second price column under "Fluorescent Lps.—12-ft. Ceiling") is $7.50.

95 outlets at $7.50 each, $712.50.

This is the selling price of the branch circuit wiring from the lighting panel to the outlets.

Check Units

In every discussion on units for electrical estimating, sooner or later one arrives at the word "must." In order for an estimator to intelligently use the tables *he must prepare check units of his own. He must also know how the tables should be adjusted to fit his labor conditions and the type of work he is doing.* There are certain changes that are in order, due to difference in labor rates, inspection charges, material costs, and insurance rates. Aside from possible reductions for such factors, one had better be pretty sure of his ground before he starts any wholesale slashing.

Adjusting the Units

Differences in labor and insurance rates are apt to be the most common causes for changing the units. The first

[Continued on page 163]

UNITS FOR PRELIM FIELD ESTIMATING

LAB. RATE 1.70/HR.

LIGHTING BRANCH WIRING—INDUSTRIAL BLDGS.

APPROX COST PER OUTLET—DOLLARS EACH (SEE NOTES FOR MARKUP)

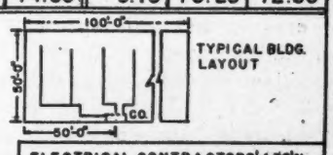
DATA							EXPOSED								CONCEALED		
WATTS PER OUTLET	SPACING OF OUT. IN FT.	WATTS PER SQ.FT.	APPROX FC. LIGHT DIRECT LTG. INCAN. OR L.M. A	B	SEMI-DIR. LTG. ENC. GL. BOWL A	B	ON CONCRETE FLAT CEIL. KO. BOX	HUB FTG.	BEAM C. FTGS.	ON WOOD FLAT CEIL. KO. BOX	HUB FTG.	BEAM C. FTGS.	STEEL TRUSS	MESSGR. CABLE	THIN SLAB	HEAVY SLAB	SUS. CEIL. (OFFICE SECT.)
			SEE NOTE 1.														
							INCANDESCENT LPS.—12 FT. CEILING										
100	10X10	1.0	6	7	4	6	6.15	7.15	8.75	5.50	6.50	8.00			5.50	5.80	6.75
150	10X10	1.5	10	12	7	10	6.50	7.50	9.20	5.90	6.80	8.40			5.85	6.15	7.10
200	10X10	2.0	14	17	9	13	6.90	7.90	9.50	6.25	7.25	8.75			6.25	6.55	7.50
200	12X12	1.39	9.5	11.5	6	9	7.60	8.60	11.30	6.60	7.60	10.30			6.90	7.30	8.35
200	16X16	0.78	5.5	6.5	3.5	5	9.50	10.50	14.25	8.00	9.10	12.80			8.50	9.00	10.30
300	10X10	3.0	23	28	15	22	7.10	8.10	9.70	6.45	7.45	9.00			6.40	6.70	7.70
300	12X12	2.08	15.5	18.5	10	15	8.10	9.10	11.80	7.00	8.00	10.70			7.30	7.60	8.80
300	16X16	1.17	8.5	10.5	6	9	10.00	11.00	14.00	8.60	9.60	13.40			9.40	9.50	11.00
300	20X20	0.75	5.5	7	3.5	5	11.50	12.50	16.00	9.80	10.80	14.30			10.00	10.50	—
500	12X12	3.47	25	30	10.5	25	10.00	11.00	13.80	9.00	10.00	12.70			9.20	9.70	10.70
500	16X16	1.95	14	17	9.5	14	12.00	13.00	17.80	10.80	11.80	16.60			11.00	11.50	12.80
500	20X20	1.25	9	11	6	9	14.00	15.00	19.00	11.90	12.90	17.50			13.00	13.80	—
							INCANDESCENT LPS.—16 FT. CEILING										
200	12X12	1.39	9	11	6	9	8.60	9.75	12.75	7.50	8.60	11.60	10.75	11.00	7.40	7.80	
200	16X16	0.78	5.5	6.5	3.5	5	11.00	12.20	16.50	9.10	10.25	14.40	13.00	13.50	9.50	9.90	
300	12X12	2.08	15	18	10	15	9.15	10.25	13.25	7.90	9.10	12.10	11.25	11.50	8.80	9.20	
300	16X16	1.17	8	10	5	8	11.25	12.50	16.00	9.80	10.90	15.25	13.75	14.25	10.00	10.50	
500	12X12	3.47	25	30	16	25	11.30	12.50	15.70	10.20	11.30	14.50	13.50	13.75	9.90	10.30	
500	16X16	1.95	14	17	9.5	14	13.50	14.50	20.00	12.10	13.00	17.80	16.25	16.75	12.00	12.80	
500	20X20	1.25	9	11	6	9	15.55	16.40	21.00	12.90	14.00	19.70	17.50	18.50	13.75	14.50	
750	16X16	2.93	21	25	14	21	15.00	16.25	21.00	12.75	13.75	18.60	17.00	17.50	13.50	14.25	
750	20X20	1.87	13	16	10	13	16.25	17.50	22.00	13.50	14.75	19.50	18.00	19.00	14.75	15.50	
							FLUORESCENT LPS.—12 FT. CEILING										
			RLM FIXTURES LAMPS		APPROX FC												
100	10X10		2-40W.		16	22*	6.15	7.15	8.75	5.50	6.50	8.00			5.50	5.80	6.75
100	12X12		2-40W.		11	15	6.70	7.70	9.30	6.00	7.00	8.50			6.10	6.40	7.40
150	10X10		3-40W.		22	30	6.50	7.50	9.20	5.90	6.80	8.40			5.85	6.15	7.10
150	12X12		3-40W.		15	21	7.10	8.10	9.90	6.50	7.40	9.00			6.40	6.75	7.80
250	12X12		2-100W.		22	30	7.35	8.35	11.50	6.80	7.80	10.50			7.00	7.35	8.05
250	16X16		2-100W.		12	16	10.00	11.00	14.80	8.35	9.35	13.10			9.00	9.50	10.80
							FLUORESCENT LPS.—16 FT. CEILING										
150	10X10		3-40W.		22	30	7.30	8.40	10.00	6.60	7.60	9.50		10.00	6.70	7.00	7.90
150	12X12		3-40W.		15	25	8.00	9.10	11.00	7.30	8.30	10.00		11.00	7.20	7.55	8.70
250	12X12		2-100W.		22	30	8.20	9.30	12.30	7.70	8.80	11.50		11.25	7.30	7.65	8.90
250	16X16		2-100W.		12	16	11.25	12.35	16.50	9.30	10.40	14.80	13.50	14.00	9.75	10.25	12.00

NOTES:

① CONDITIONS FOR LIGHTING
"A"—FAIR
"B"—GOOD

② LABOR BURDEN & MARKUPS
20% WAS ADDED TO INSTALN. LABOR FOR INSURANCES, TOOLS & OTHER DIR. JOB COSTS.
MARKUPS USED: MATERIAL—10% FOR GEN. OVERHEAD AND RETURN.
LABOR —15% FOR GEN. OVERHEAD AND 10% FOR RETURN.

③ SEE SEPARATE TABLES FOR SERVICE, FEEDER, AND PANEL UNITS



TYPICAL BLDG. LAYOUT

ELECTRICAL CONTRACTORS' ASS'N. OF CITY OF CHICAGO
E.W.A. 11-20-45

TABLE 1—Unit costs (contractor's selling prices) per outlet for lighting branch circuit wiring in industrial buildings, listed for various types and sizes of fixtures, outlet spacings, and installation conditions. To the estimate derived from these units must be added cost of installing service, feeders, panels, special control methods, supply and installation of fixtures, to develop complete lighting system cost.

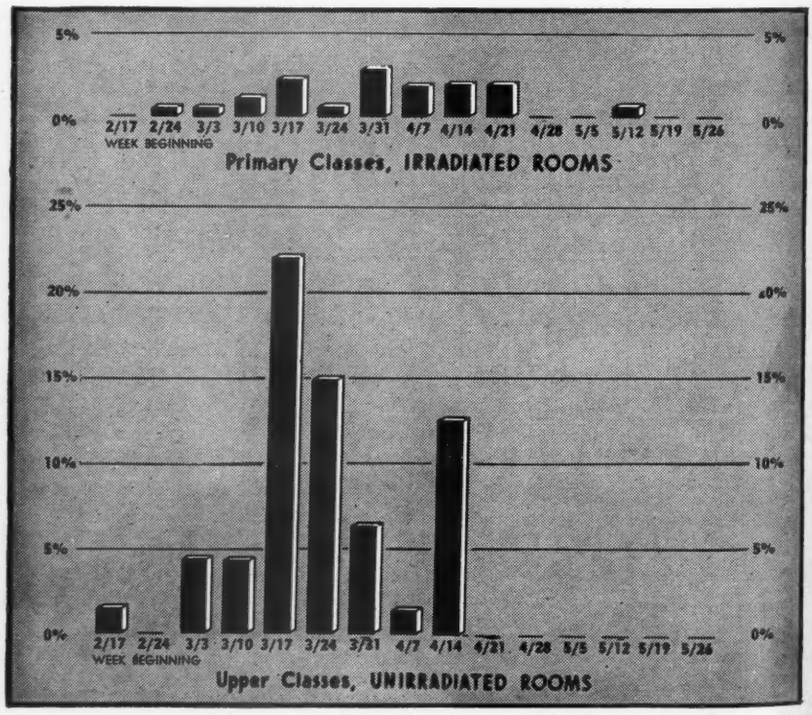
***LABORATORY APPLICATION** shows germicidal lamps (circled) mounted above shelves of chemicals to prevent contamination of solutions used in making chemical analyses in this manufacturing plant.*

The Electrical WAR ON DISEASE

ULTRA-VIOLET energy provides a practical method of effectively killing air-borne bacteria. The weapon is that young and more deadly sister of the fluorescent lamp—the germicidal lamp designed to effectively reduce the spread of sickness and disease air-borne germs. The 400,000,000 common colds that yearly assail the American public and cause the loss of nearly a billion productive man-hours is a well known example of what must be combated.

It took years of statistical and educational work to establish the value of Pasteurizing milk and chlorinating water. Air disinfection has lagged behind these developments primarily because only recently have techniques been developed that reveal in the air of an ordinary room exactly the same germ cultures as are in the throat. The transfer of measles and strep infections between children entirely by air-borne bacteria, without the aid of toys and objects placed in the mouth, has been proven. Also, until the last three or four years there has been no practical means of doing the job. The seriousness of air-borne infection in hospitals and the value or air disinfection today is attested by scores of papers published in medical and public health magazines.

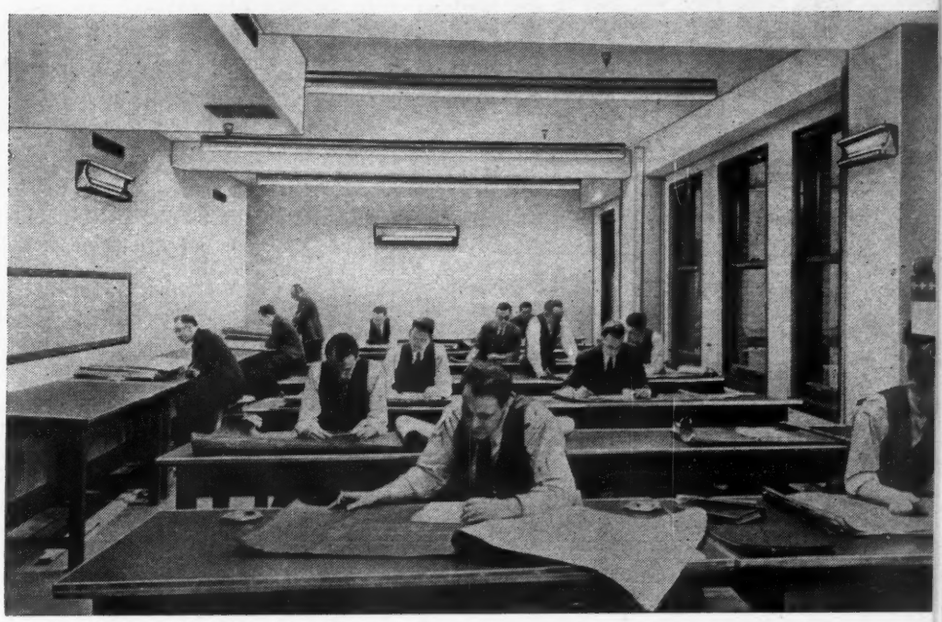
Now that we have the germicidal lamp and know its effectiveness, where can



***GERMICIDAL LAMPS** in primary classes of Philadelphia's schools materially lowered the attack rate during an epidemic of measles. Charts indicate percentage of susceptible pupils who contracted the disease. Note remarkable difference between irradiated and unirradiated classrooms.*

A research scientist evaluates the postwar possibilities of germicidal lamps as the theory of air disinfection becomes a practicable reality.

By Dr. L. J. Buttolph
Research Laboratories
General Electric Company
Nela Park, Cleveland, Ohio



***ULTRA-VIOLET** radiation from wall-mounted germicidal lamps disinfects the air in this plan room of an engineering firm's offices.*

it best be applied? Let's review briefly the potential markets.

Hospitals—The Council on Physical Therapy of the American Medical Association is now formally approving five or six germicidal lamp fixtures for hospital use. Although promotion has been greatly restricted, demand has doubled —increased 100 percent each successive year for the past four years. Last year the hospital business of a single company took one-third to one-half of all germicidal lamps available. This represented just a sampling of the market for equipping all parts of all hospitals in the United States.

The germicidal lamp is a valuable preventive device for a large number of airborne diseases affecting babies, children, adults and animals. Being for general use, it places no restrictions on movement or time of those benefiting by it. Since it is for continuous use it offers an attractive source of replacement lamp business.

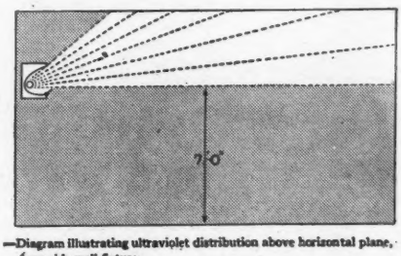
Schools—Second only to the hospital in availability, but greatly exceeding it as an eventual market, is the use of germicidal lamps in school rooms. While not yet generally approved by the Public Health authorities, it will probably be only a matter of a few years before such installations will be generally recommended. This will lead to a fixture and lamp business equivalent to one-fifth that of relighting all schools in the U. S. in an ideal manner with fluorescent lamps; or fully equivalent to relighting these schools entirely on the present basis.

Factories and Offices—The third general use of air disinfection equipment is for protection of adults from throat infections, colds and influenza in crowded factories and offices. Amusement places and even the home and individual office offer another field for thorough exploration. Although, to date, the value of air disinfection under these conditions has been less conclusively demonstrated than in the case of hospitals and schools, further research can be expected. Although no controlled statistical method of evaluating the effectiveness of air disinfection in this field has yet been developed, it seems inevitable that broad and satisfactory acceptance will be made on the basis of authenticated results in hospitals and schools. A potential market as broad as the whole indoor lighting field will then be opened.

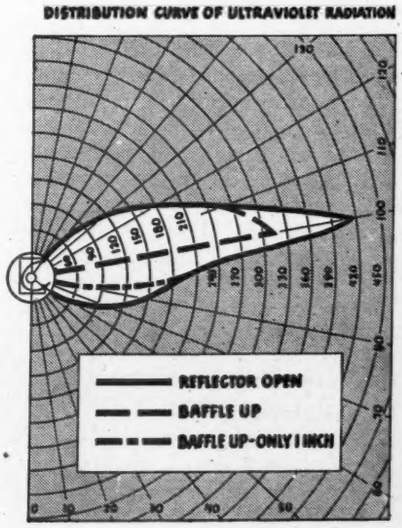
Air Ducts—From a theoretical standpoint, the disinfection of air by placing lamps in a duct, or in an air circulating device such as a room air conditioner, is the ideal method. The National Institute of Health has shown that B coli sprayed into the basement room in one corner of a building appeared a few minutes later in a diagonally opposite room on the fourth floor. The use of germicidal lamps as accessory equipment with air conditioning devices and systems could be a highly probable future market.

Meat Storage—Lighting specialists believe that germicidal lamps, properly used, will improve the sanitary conditions of practically all meat storage places. Companies servicing the refrigeration in retail walk-in meat coolers provide an immediate possible outlet. Manufacturers and distributors of the quick-freeze locker plants, being estab-

(Continued on Page 162)



—Diagram illustrating ultraviolet distribution above horizontal plane, from side wall fixture.



BRIEF ARTICLES about practical methods of installation and maintaining electrical wiring and equipment and up-to-date estimating and office practices. Readers are invited to contribute items from their experience to this department. All articles used will be paid for.

PRACTICAL METHODS

GROUND CLAMP WARNING

WIRING

At the suggestion and recommendation of an electrical inspector, one of the leading manufacturers of ground fittings, The Thomas & Betts Company, are now attaching a bright red tag to every ground fitting leaving the factory. The tag carries the warning, "Do Not Remove" on both sides and a brief explanation. "This ground clamp is installed for the protection of life and property and for the safe operation of the electrical system within this building. If you find this ground clamp or the wire broken, loose or disconnected, call your electrician immediately."

HOOK RACKS FOR SPOT WELDER CONTROLS

WIRING

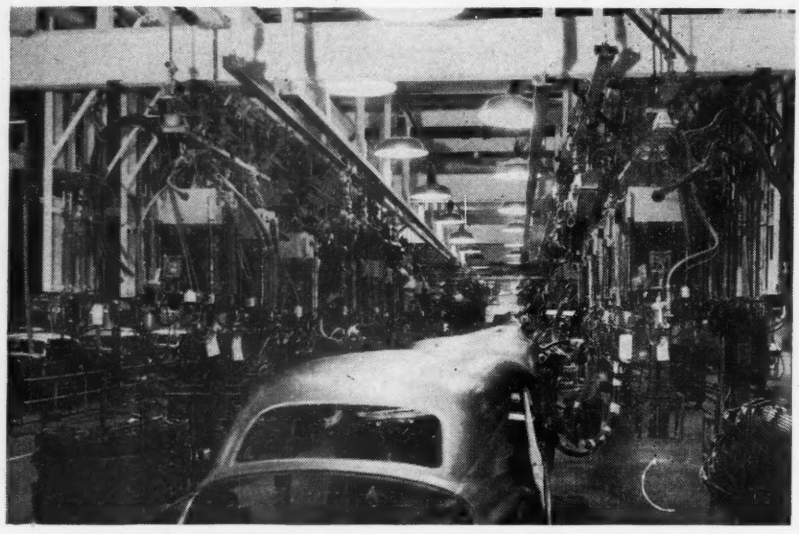
Early in their travels along the assembly lines at Flint's Fisher Body Division of General Motors Corporation, automobile bodies wend their way through the "jungles," a 200-ft. lane lined on both sides with suspended resistance spot welding units. As the conveyorized line slowly progresses down the lane, employees spot weld body sections, each man completing a specified number of welds, then passing on to the next body in line.

Each spot welding "jaw" has its own individual 440-volt, single-phase, 75 kw. transformer suspended from a monorail trolley—providing sufficient mobility for the welder to follow conveyor progress for a short distance and eliminating long, tanglesome cord and hose connections.

Service to the transformers comes from a 1000-ampere plug-in type distribution bus duct line installed parallel to the monorail and between it and the electrical control racks. A 200-ampere, fused bus plug feeds each group of controls.

Typical control equipment for each welder unit consists of a 200-amp. unfused disconnect switch (pole-operated from the floor); a synchro-break contactor; welding timer; and a 30-ampere disconnect switch for the 24-volt control circuit to the operator's pushbutton. All of these units are group-mounted to an angle-iron rack consisting of two inverted-J uprights with the necessary horizontal and vertical cross-pieces to accommodate the various control items.

The inverted-J uprights form convenient "hooks" for suspending the control rack from a channel iron which parallels



Spot welding "jungles" at the Fisher Body plant showing monorail suspension of the individual welding transformers.

Hook racks suspended from a channel-iron beam accommodate the grouped control equipment for each welding unit. Main disconnect switch, fed by a 200-amp. bus plug, is pole operated from floor level. Rack can be quickly and easily lifted from beam and moved, as a complete unit, to a new location.

EASY ON UPKEEP...

Structure, Bus Bars and Fittings are all **Alcoa Aluminum**

Protection against the elements is built right into this outdoor substation. It's Alcoa Aluminum throughout. Needs no painting, ever, so you're spared that expense and hazard.

Alcoa Aluminum structural shapes are available in all forms required for such construction. They are assembled with aluminum bolts or rivets. Or they may be welded. Large, lightweight, shop-fabricated sections cut time and labor for field erection of structures.

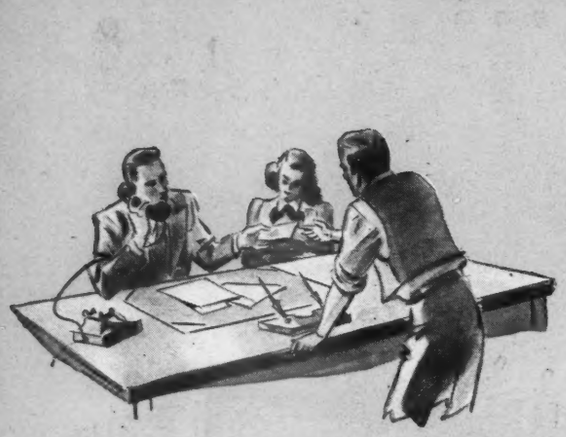
Alcoa Aluminum bus bars are available as flats, rounds, tubes, channels, and angles. Their lighter weight places less burden on supports, often permitting economies in construction.

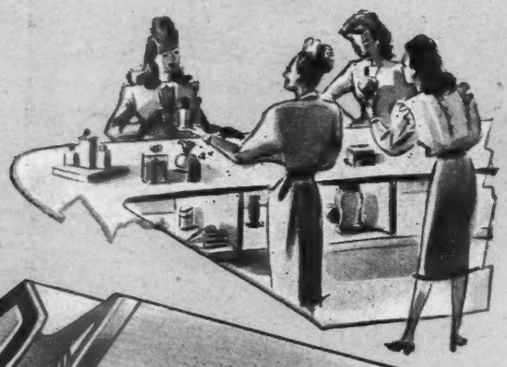
For data on structural shapes and fastenings, bus bars and fittings, get in touch with the nearest Alcoa office. Or write ALUMINUM COMPANY OF AMERICA, 2197 Gulf Bldg., Pittsburgh 19, Penna.

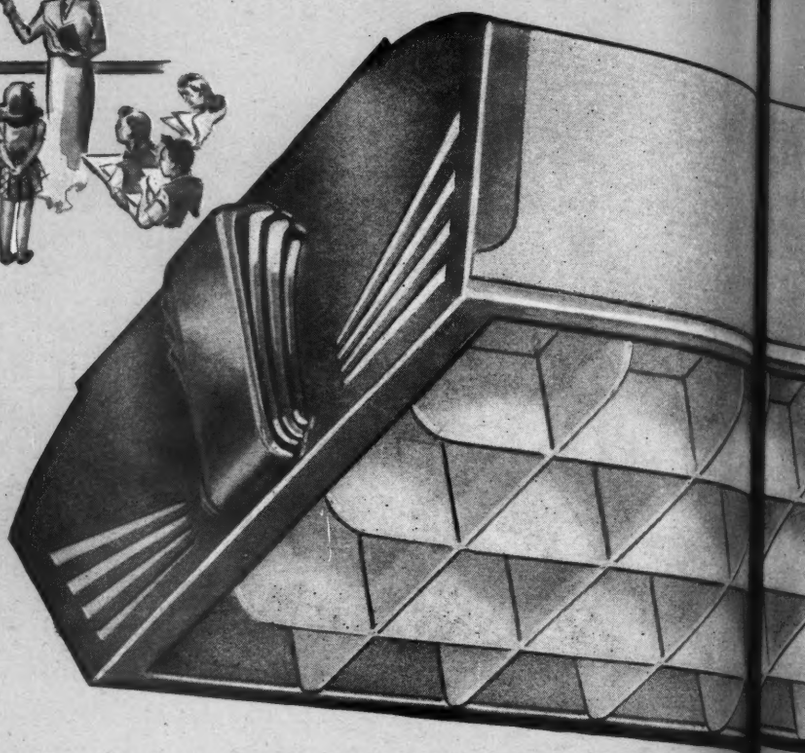
ALCOA ALUMINUM

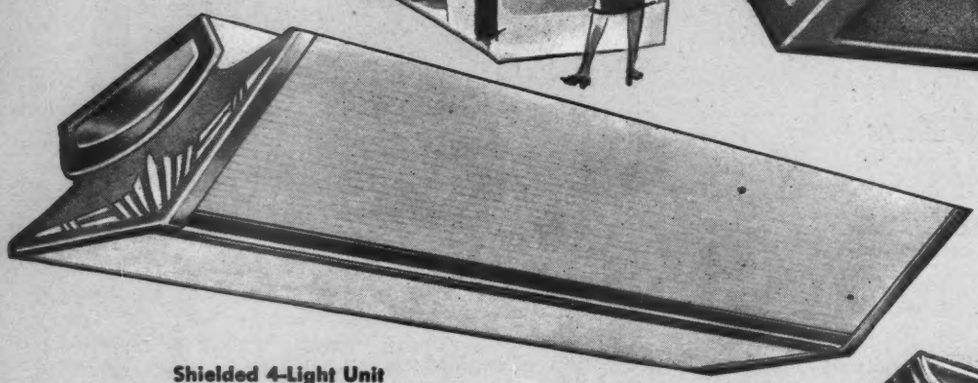
NOW . . . *Commercial*

MITCHELL INTRODUCES

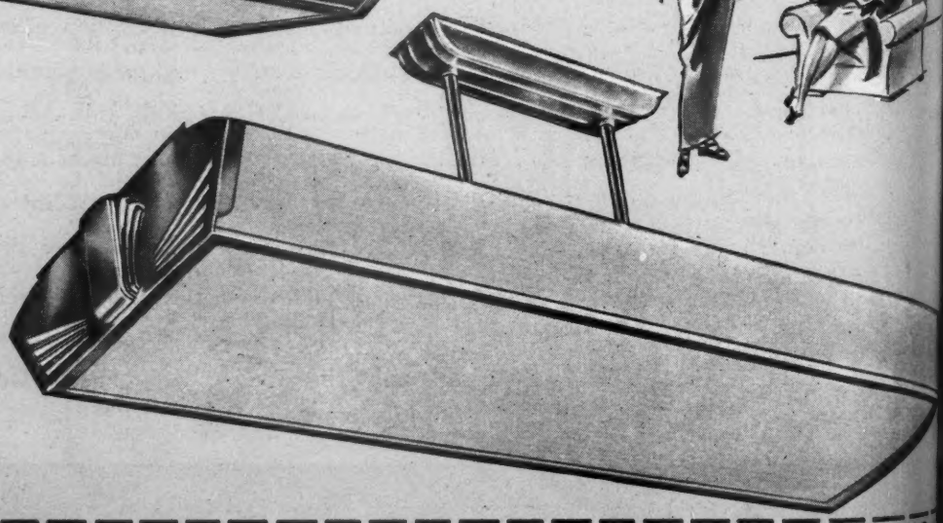




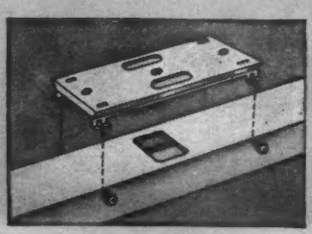




Shielded 4-Light Unit
Model No. 3004
(2-Light Model No. 3003)



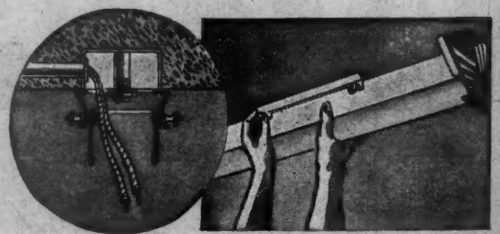
Deluxe Shielded 4-Light
Model No. 3007
(2-Light Model No. 3005)



ONE-MAN QUICK-MOUNT

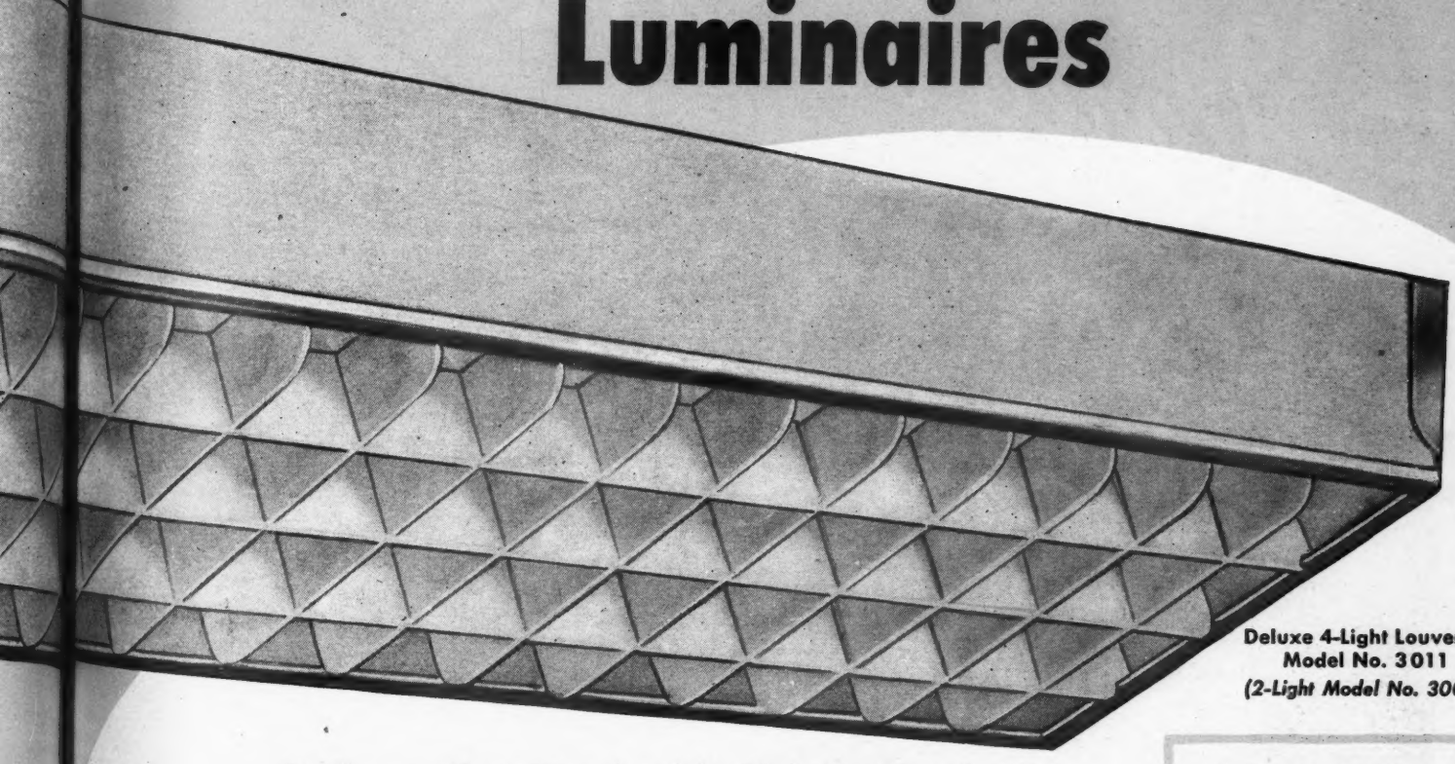
Permits one man to install a 2-light or 4-light fixture in less than half the normal time. Ceiling Plate is mounted to ceiling. Wireway Channel is raised to Ceiling Plate and securely fastened with 4 Captive Knurled Nuts.

Cross-Section shows house wires drawn through Ceiling Plate and Channel. Note open construction for convenient inspection. Wireway Channel secured into position for quick splicing of house wires to fixture wires.



Lighting Takes Another Step Forward!

ENTIRELY NEW AND COMPLETE LINE OF Commercial Fluorescent Luminaires



Deluxe 4-Light Louvered
Model No. 3011
(2-Light Model No. 3009)

Setting a New Standard in Lighting Service!

Offering Exciting New Modern Designs in 2-Light and 4-Light Units . . . Glass-Shielded, Louvered and Open Types • Instant Start • New Patented "One-Man Quick-Mount"!

New opportunities for sales and profits . . . *greater than you've ever known* . . . are open to you now! For MITCHELL ingenuity brings you modern Luminaires to answer every demand for soft, glare-free lighting in stores, offices, schools, public buildings! In this new complete line, you get *a dozen and more vital advantages* that enable you to provide the *finest lighting performance on the market!* Installation is simpler than ever. Maintenance is made easier for servicing economy. Values are exceptional because each unit does a big job for the money.

Add to all this the great record and nation-wide acceptance achieved by MITCHELL products through the years . . . and you have the *strongest selling line today!* Build a big commercial lighting business. Get volume sales and volume profits. Sell MITCHELL Luminaires in 1946!

Get New Catalog No. 285

Use this powerful sales aid. Illustrates and describes complete line of Commercial Luminaires. Includes helpful lighting data, installation and servicing information! Write for it now!

ALL THESE FEATURES!

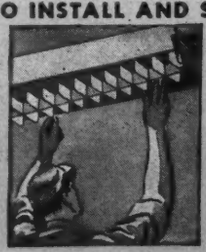
1. Higher Light Output—Less Glare
2. Scientific Shielding
3. Proper Lamp Spacing
4. True, Full-Depth Louvers
5. Luminous End Plates
6. Instant Start
7. Surface or Suspension Mounting
8. Quick, Easy Installation and Servicing
9. One-Man Quick-Mount
10. Fleur-o-Lier, U.L. and E.T.L. Approved
11. Single Carton Packing
12. Mitchell Guarantee

Mitchell Manufacturing Company
2525 CLYBOURN AVENUE, CHICAGO 14, ILLINOIS
West Coast Factory and Sales Office: 1019 N. Madison Ave., Los Angeles 27, Cal.

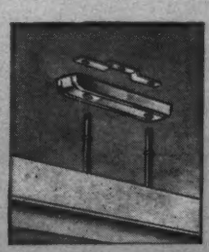
MITCHELL
FOR TOP LIGHTING VALUE

EASY TO INSTALL AND SERVICE

New, improved heavy-gauge steel wireway channels, with abundant knock-outs for mounting and wiring. Wires, sockets, starters, glass panels, louvers, and other components are readily accessible for replacement, servicing, cleaning.



Units may be surface mounted direct to ceiling, or suspended by Canopy and Stem Set (extra). Models illustrated above may easily be joined end-to-end in continuous rows.



MAKERS OF

Commercial and Industrial Fluorescent Lighting Equipment • Store Window Lighting • Spotlights and Floodlights • Desk Lamps • Portable Floor and Table Lamps • Bed Lamps • Ultraviolet and Infrared Health Lamps • Residential Lighting Specialties

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Discover for yourself the many reasons for the outstanding superiority of Pedigree Varnishes. Let their performance prove their merit . . . convince yourself that each one is a winner.

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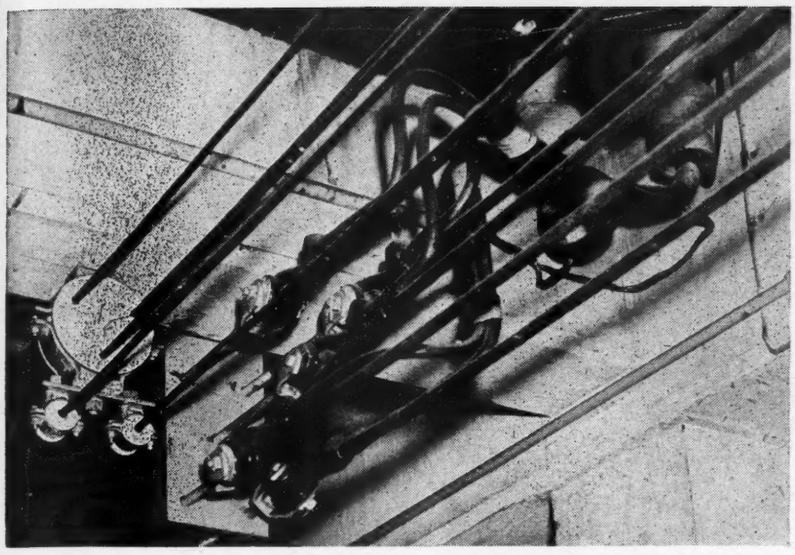
THE P. D. GEORGE COMPANY, ST. LOUIS, U. S. A.



Dead-end feeder to an electric furnace under the nitriding department of Chrysler Corporation's Dodge-Chicago Plant. Open conductors loop around dead end insulator spools before entering conduits of furnace. Conductor tension is applied by taking up nuts on insulator bolts projecting through the channel-iron bracket fastened to the concrete beam.

the bus duct distribution line. In the event of a shift to another line, or to a different spot on the same line, the feeder bus plug is disconnected and the control rack moved, as a complete unit, to the new location.

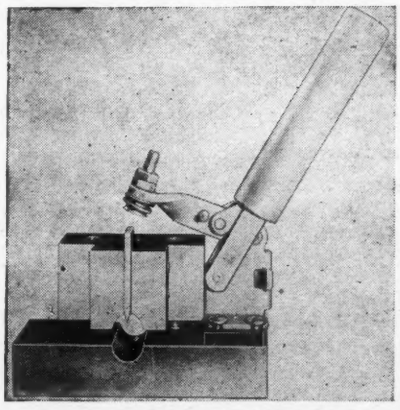
Approximately 240 of these resistance spot welding units are used in the plant. The flexible features of the installation reduces to a minimum the time required to re-install units when a shift in location is necessary.

INSULATION STRIPPER

WIRING

Shops employed in stripping insulation from heavy cable will appreciate the simple design and construction details of a stripper designed by A. H. Langlois of the Westinghouse Corporation's Baltimore Industrial Electronics Division.

The tool primarily consists of a base block, an upper block containing an adjustable knife and a toggle clamp. Both blocks have facing semicircular recesses which, when in a clamped position, form a guiding track around the cable. The knife blade can be adjusted to any desired cutting depth by means of two set screws. The blocks are bored to receive guide pins that maintain correct alignment of the grooves and knife edge and springs to separate the blocks when the toggle clamp is released. After the cable is clamped in the circular track, it is manually pulled through the tool.



Simple design permits shop duplication of insulation stripper which promotes safety, speed and efficiency of heavy cable stripping.

In operation the device strips cable quickly, easily and safely. The simple design makes it easy to build in any shop.

NEW HAND BENDING TOOL SAVES TIME

INDUSTRIAL

A new hand-bending tool, which permits all kinds of small tubing to be curved to any desired angle, has been developed at the Glenn L. Martin Company, Baltimore, Maryland.

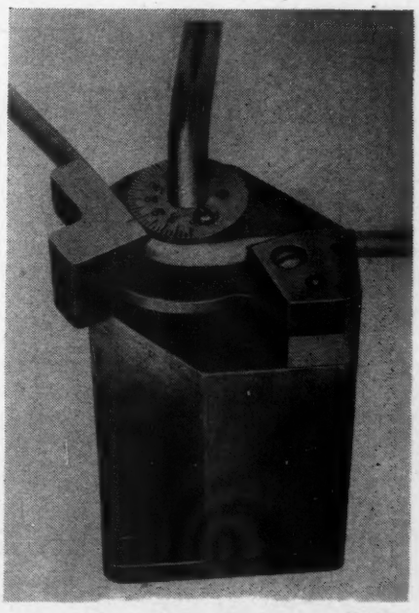
Designed by a Martin employee, Carroll E. Adreon, the new tool consists of a sturdy steel base which may be used in a vise or clamped onto a bench; a revolving radius rod equipped with a handle for turning; a stop block grooved to hold the tubing; and a movable radius block which guides the tubing around a bend roll centered on top the base. This roll, cylindrical in shape and also grooved has a top plate scribed in 360 degrees. A measuring point is marked on the movable radius block. The radius and holding blocks and the roll are so grooved as to prevent crushing or change in section of the tubing.

In operation the tubing is inserted in the groove of the stop block and the movable block which has been returned to the zero degree point. The movable block is then pulled around the bend roll, being connected to the revolving radius rod, until the measuring point is directly opposite the mark of the angle desired in the bend roll.

Allowances can be made for tubing having a "spring back" characteristic by merely moving the measuring point to as many degrees beyond the desired angle marking as the tube will spring back when released. An operator can easily measure this amount of allowance needed from the spring back shown on the top plate of the bend roll, when pressure on the handle is released. Utilizing the same principle, tools may be made for bending tubing of any size.

By the simple substitution of a set of phenol fibre blocks, similar in design to the metal blocks, hot-dipped or tinned spiral high-electrical cables (for example, battery cables) also can be bent in the new tool. Use of the phenol fibre accessories prevents the semi-molten coating on the wire from adhering to the blocks, as would be the case with use of the steel blocks on the original tool.

Chief advantages of the new device lies in the great amount of time saved



This steel-base hand-bending tool which permits speedy bending of all kinds of small tubing, was developed by Glenn L. Martin Co., Baltimore.

A SWEETHEART FOR PROFITS

HOLDENLINE CHAN'L-RUN

Alert electrical contractors need no Valentine to remind them that HOLDENLINE CHAN'L-RUN is a sweetheart for profits the year around. For HOLDENLINE CHAN'L-RUN is a contractor's dream, planned for speed and ease of installation, built for a minimum of servicing.

It's natural for the customer to specify HOLDENLINE CHAN'L-RUN, too, for experienced engineering has built into these fixtures exceptional strength and durability, extreme flexibility, simplicity and beauty.

And the contractor knows he's chosen right when he finds how quickly and easily HOLDENLINE CHAN'L-RUN is converted into continuous run. Standard units adapt themselves to every job—no odd lengths to stock.

Four features highlight HOLDENLINE CHAN'L-RUN, each an advantage that has aided industry to better, faster production with less waste and fewer errors.

1. High lighting efficiency. Reflectors photometrically designed.
2. No lamp or socket breakage. Sockets mounted on welded steel plates.
3. Ample wire freeway permits easy conversion.
4. No dark areas between lamps on 2½" centers with CS S-80.

You'll Welcome the New HOLDENLINE Units. They're on the Way!

Now being carefully pre-tested are new fixture designs soon to be released. They'll be worthy additions to the soundly engineered line that established HOLDENLINE as a pioneer in fluorescent. Watch for them.

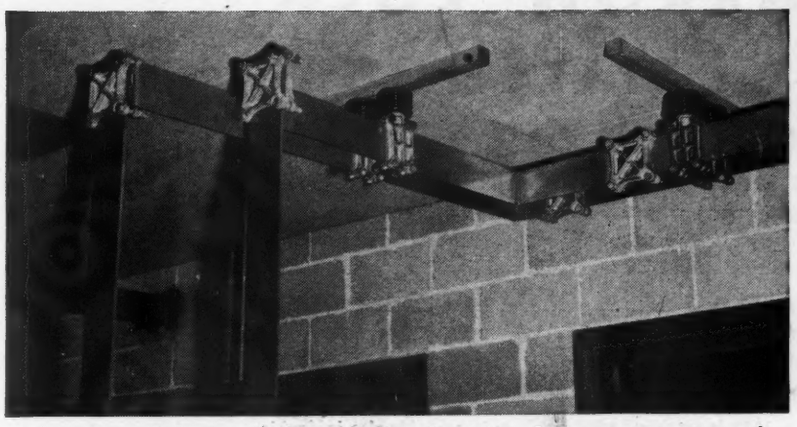
Your Wholesaler Will Supply Bulletin B-45 or write direct

HOLDENLINE COMPANY

Pioneers in Fluorescent

1960 EAST 57TH STREET • CLEVELAND 3, OHIO

as compared to ordinary hand bending operations, the extreme accuracy to which the tubing can be turned and a material saving in that there is no scrap due to the tubing being crushed or split during the operation.



Accurate alignment of these plating buses in the generator room of the Dodge-Chicago Plant, Div. of Chrysler Corporation is facilitated by use of a specially designed channel section on which the supporting insulators can be rigidly positioned at any point along its length. Note square bus clamps used on lap joints of bus runs.

WIRING FOR PAPER MILLS

INDUSTRIAL

Modern paper making is nothing more than a refinement of the basic methods of the ancients brought up to date to fit into the complex life of today. And electricity as well as steam has played an important part in this progress. Now we can see a wood log enter one end of a long process and emerge at the other end as a continuous roll of paper pulp, or even the finished product. And it is all made possible by the use of power and control.

The application of electric motors and intricate control circuiting has made practical the integration of the various process steps of paper making into one huge machine working as a single unit. Accurate timing and speed control is necessary to keep one part of the machine from running ahead of the other. For the modern paper machine may have close to one hundred different motors operating simultaneously and the failure of one motor may interrupt the whole process. This requires the application of interlocking devices, photo-electric control, other signal systems.

And with machines of this size and type, localized lighting is important to watch the progress of the paper and repair and maintain the large number of motors that operate the machine.

Remote control is especially important in this industry. The paper machine is so large that there is seldom room on the machine floor to install the control equipment for the numerous motors. There is barely enough room for the larger dryer drive motors and most of the large pumps and fan motors must be placed in the basement floors. But operators on the machine floor must be able to control the motor operation, hence the need for remote control stations.

The check list gives the application of motor drives and electricity to the paper making process. It should be a useful guide to electrical contractors who are called on to do work in this type of industry.

CHECK LIST FOR PAPER MILLS

Motor Applications
(Splash - proof motors recommended in most cases)
Agitators
Air Compressors
Baling Machines
Barkers
Battery Charging Sets
Beaters
Bleaching Equipment
Chippers
Clay Tanks
Color Mixers
Conveyors
Cranes
Cutters
Drying Rolls
Dusters
Deckers
Economizers
Elevators
Emasculators
Emery Wheels
Fans, Ventilating
Filters
Glue Machines
Grinders
Hogs
Hoists
Industrial Trucks
Jordans.
Machine Tools
Paper Machines
Plates
Pulp Grinders
Pumps
Rag Cutter and Washer
Rewinders
Rolls
Saws — Band & Circular Head
Screens
Scoring
Shears
Slitters
Sulphite Digesters
Supercalenders
Thrashers
Trucks
Washers
Whips and Hoists
Winders
Wood Conveyors

Signal Systems
Bells and Horns for start and stop
Photo - electric signaling control
Code Calls
Fire Alarms
Telephones
Time Clocks
Emergency Signals

Illumination—recommended intensities
Beaters, Grinding, Calendering—20 ft-c
Finishing, Cutting, Trimming—30ft-c

FORK TRUCK POWERS MOBILE PLATFORM

INDUSTRIAL

The versatility of the fork truck suggests its use for raising a working platform to practical working levels and moving this platform quickly to satisfy local requirements. The Clark high lift Tructractor, manufactured in Battle Creek, Mich., is used by plant electricians to mount and service floodlighting equipment which illuminates loading and parking areas.

The platform is sufficiently sturdy to permit unhampered, safe movement by the men and is large enough to hold an ample supply of repair equipment and tools. Scaffolding and ladders are unnecessary and replacement parts are constantly within reach of the maintenance man. In interior areas where

Clark Tructractor raises working platform to convenient height for floodlight installation and repair. Free movement of men and sufficient space for tools and parts is permitted.

ARROW Lock Switches

With CORBIN Pin Tumbler Locks

Keep control of the lighting in proper hands! Guard against unauthorized tampering with lights in schools, hospitals, theatres, auditoriums, hotels or any other building used by the general public.

The Lock Switches pictured here are no ordinary switches with locking device. They're time-tested ARROW Rotary Snap Switches, operated only by turning the key in a Corbin Pin Tumbler Lock.

No. 1281 is standard type, single pole, available also in double pole, 3-way and 4-way. No. 1281-WP is weatherproof, with cadmium-finish screw cap plate fitting on a weathertight rubber mat. No. 1291 is a *master* lock switch, reciprocating type. After inserting key in lock, switch may be turned to right or left — ON or OFF, but key cannot be removed from switch in ON or OFF position. Write for data sheet on this *complete* line.

DISTRIBUTED THROUGH ELECTRICAL WHOLESALERS

ARROW ELECTRIC DIVISION

THE ARROW-HART & HEGEMAN ELECTRIC COMPANY, HARTFORD, CONN., U. S. A.

sufficient aisle or open floor area permits, this method can be used for fast, safe, periodic lamp maintenance checks.

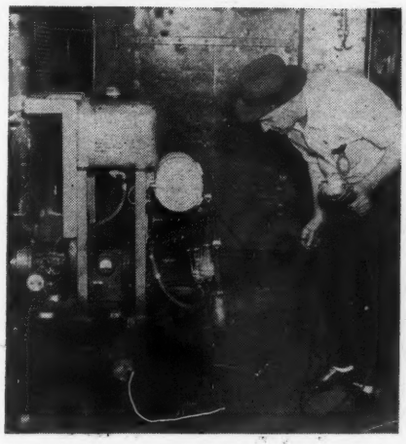
PORTABLE EMERGENCY LIGHTING GENERATOR

INDUSTRIAL

The electrical maintenance department at the Buick Motor Division of General Motors Corporation plant in Flint, Michigan, will never be without some light, no matter what happens. A small surplus gasoline-driven generator, four extension cord reels, and a bit of ingenuity assured that.

When the maintenance department acquired a 30-volt, direct current, 50-ampere, 1500-watt generator driven by a one-cylinder gasoline engine, it was promptly turned into a portable emergency lighting unit. The generator, on rubber shock-absorbers, was mounted on a rectangular steel cabinet equipped with heavy-duty casters. An angle-iron frame was built to support the gasoline tank and exhaust muffler. To this frame was added a convenience outlet, connection block and four extension cord reels, each equipped with a heavy-duty hand lamp complete with wire guard and 100-watt, 30-volt lamp.

The steel cabinet at the base of the unit has hinged doors and can be used for storage of tools and necessary electrical repair items. The complete unit



Portable emergency lighting unit, 1500-watt 30-volt, d-c generator driven by one-cylinder gasoline engine, with integral tool and spare parts cabinet developed by Buick's electrical maintenance department at Flint, Michigan.

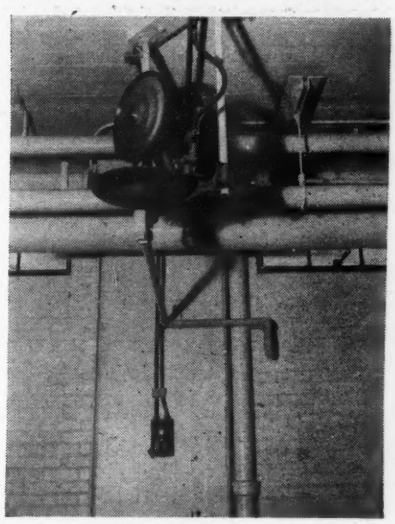
can be moved to any point in the plant where emergency lighting for repair purposes is needed.

HUMIDIFIERS REDUCE STATIC ELECTRICITY HAZARD

INDUSTRIAL

At some time or other, everyone has experienced the phenomenon of static electricity—drawing sparks when opening the door after walking across the living room rug. Multiply this condition by several fold, more people, more contacts, more area, and a formidable hazard will exist. That was the problem in the "cut and sew" department of the Fisher Body Division of General Motors Corporation in Flint, Mich., where automobile upholstery is manufactured. Here, in a 900-ft. by 80-ft. "room" employees work at long cutting tables and long lines of sewing machines—always in contact with the upholstery fabric; each person unwittingly becoming a static generator.

The degree of hazard from static discharges, however, has been reduced as much as 90 percent. Solution: The engineering department decided to humidify the air in this specific area. This was accomplished by installing automatic humidifiers (see illustration) close to the ceiling on each side of the area and staggered on 80-ft. centers.



Individual automatic humidifier, on 80-ft. centers, cut static electricity hazard 90 percent in the "cut and sew" upholstery department of the Flint's Fisher Body Division, General Motors Corp. plant.

Each unit consists of a large cone-shaped ejector which produces a fine moisture spray. Directly behind this cone, and an integral part of the unit, is a motor-driven fan which forces the fine water spray into the air. A drip-pan under the ejector catches the excess moisture. Control of humidification is provided by a humidistat attached to the unit and circuit protection is effected through a thermal switch mounted on the wall directly under the unit.

Fires attributed to static electricity, formerly experienced in the department, are now practically non-existent.

Due to the increased humidity of the air, nasal passages of employees are less affected by lint. Absenteeism due to colds has been noticeably reduced since the humidifiers were installed.

Lighting unit in Buick's motor repair shop where it was assembled.

from bridges to fuses

New Fuse Design
Utilizes Bridge Building Experience
In Compensating For Expansion and Contraction

A primary engineering principle of bridge building is proper allowance for expansion and contraction due to extreme temperature variations. This same construction feature has now been applied to the precision engineering of Jefferson Renewable Fuses. Instead of permanently securing the ends of the fibre "bridge"—used to support the blade and link assembly—provision is made for securely holding the knife blades in alignment while at the same time allowing enough freedom of motion to avoid unbalanced strains and buckling. Consequently, regardless of alternate heating and cooling, or change in humidity, which may affect the Fibre Barrel, the fuse knife blades are held constantly in alignment.

This added feature of reliability and efficiency, plus the protection given by Jefferson Renewable Fuses under the stress of heavy overloads or short circuits, is a natural outcome of Jefferson research and engineering progress. Specify Jefferson Fuses for extra protection to valuable electrical equipment, easy renewal, and long fuse life. JEFFERSON ELECTRIC COMPANY, Bellwood (Suburb of Chicago), Illinois. In Canada: Canadian Jefferson Electric Co., Ltd., 384 Pape Avenue, Toronto, Ont.

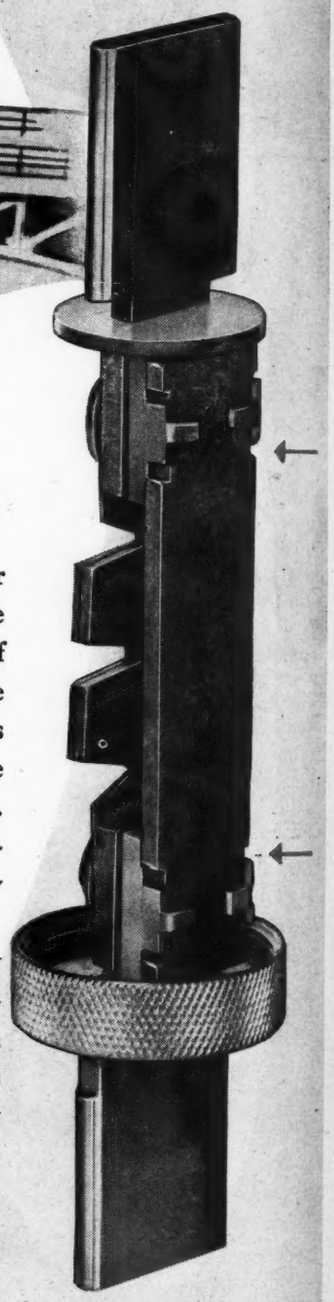


Illustration reveals new assembly construction, on improved Jefferson Renewable Fuse, which compensates for expansion and contraction to insure long-life alignment.

JEFFERSON UNION *Renewable* FUSES

JEFFERSON ELECTRIC

DATA SHEET

The number at the right is a classification for convenience in filing and for a future data sheet index

XBI

Installing Plug-In Bus Duct

(Comparatively small quantity)

BUILDING CONSTRUCTION:

The building was of wood construction with sawtooth roof and heavy wood timbers outlining the bays; span between trusses, 20 feet; roof pitch low point, 12 ft. above floor and high point 19 ft. above floor. Two heavy roof joists occurred longitudinally in each bay supporting the roof at three equidistant points per bay.

NATURE OF JOB:

The electrical work consisted of installing 120 feet of 400-amp. plug-in bus duct.

JOB CONDITIONS:

The duct was suspended 4 inches below and at right angles to the heavy timbers, crossing the sawtooth design. Duct was aligned directly under one of the heavy roof joists. Where heavy timbers were crossed, the duct was supported by two 12-gauge straps bolted to the duct and lagged into the timber with 3/8-in. lag bolts. Where duct supports occurred between the heavy timbers on 20-ft. centers, three 3/8 rods at 5-foot intervals were fastened to the roof joist. Since the sawtooth construction was not true in all bays and the intermediate supporting rods occurred in the sawtooth pitch, each rod had a different length precluding quantity production of the rods. The electricians worked from scaffolds.

LABOR DATA:

See table upper right.

LABOR ANALYSIS:

The above labor would apply to a relatively clear floor area where the duct is being supported from wood construction. The only abnormal condition was the variation in length of the duct supporting rods. If the roof structure to which the duct was supported was level, measurement and fabrication of the supporting rods would drop to approximately 0.6 man-hours each. If the floor were congested, all of the installation units would be approximately 20 percent higher. In the above job, the duct was set down on the job by the delivering agency and remained there until it was distributed. More often than not, the duct has to be moved at least one additional time prior to distribution. The above unit covering moving and distribution of duct is low; a good average unit to use would be 0.005 man-hours per pound of duct.

LABOR DATA

Work Involved	Quantity	Man-Hours	
		Unit	Total
Move material to location and distribute	1131 lbs.	0.00265 per lb.	3.00
Measure for supporting rods, string lines, fabricate rods	18	1.0	18.00
Install supporting rods.....	18	0.25	4.50
Install straps at timbers	14	0.25	3.50
Install cable tap box (no conductor or lug labor)	1	.....	1.50
Install 400-amp. plug-in bus duct	120 ft.	0.18 per ft.	21.60
Install duct end caps.....	2	0.15	0.30
	TOTAL TIME FOR JOB		52.40
Avg. Time per Foot of Duct Installed			0.436

LABOR CLASSIFICATION:

One "A" man and one "B" man were used on the job.

The types of available labor are rated A-B-C-D-E, with the units based upon the average use of "B" labor. In general an "A" man will run the job assisted by "B" and "C" labor, which will average class "B". In abnormal times the general labor classification will fall to "D" and "E" for new labor being employed to fortify the regular personnel. It must be noted that the classification applies only to rate of time and not to knowledge or mechanical ability. A splendid mechanic may be rated "C" from the rate of time classification.

Labor Classification	Changes in Standard Units
A.....	deduct 10%
B.....	no change
C.....	add 10%
D.....	add 20%
E.....	add 30%

The labor classification shown in the estimating data above shows the labor classification rating of the mechanics who performed the particular job so that adjustment can be made on the type of labor available.

Data from L. W. Witz, Continental Electrical Construction Co., Chicago, Ill.

CENTRAL
RIGID STEEL
CONDUIT

"There's Tested Strength in Every Length"

The excellence of its past performance assures its future demand.

SPANG-CHALFANT

Division of The National Supply Company

General Sales Office: Grant Building, Pittsburgh 30, Pa.

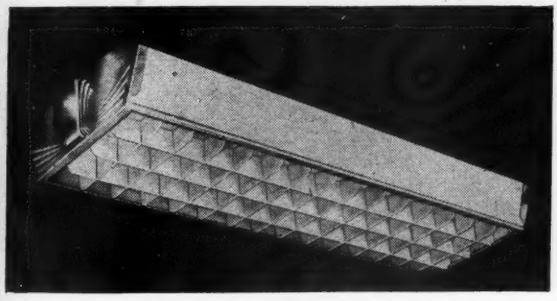
District Offices and Sales Representatives in Principal Cities

THESE ANNOUNCEMENTS of new equipment are necessarily brief—for more detailed description, sizes, prices and other data write to the manufacturers' advertising departments, tell them in what issue of ELECTRICAL CONTRACTING you saw the item and they will send full details to you.

EQUIPMENT NEWS

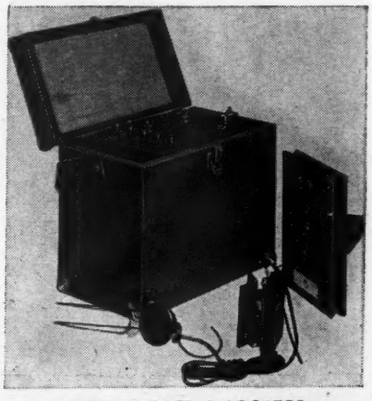
Fluorescent Luminaires

This new fixture may be flush or suspension mounted as a single unit or in continuous runs. The individual luminaires, obtained with either two or four 40 watt lamps, transmit direct light while eliminating glare from all normal viewing angles by the use of extra-depth metal louvers. White baked enamel reflectors also direct diffused rays through the ceramic treated glass side panels. It is claimed that wiring, hanging, servicing and cleaning is a one-man job. Instant start or conventional ballasts are available. Mitchell Mfg. Co., 2525 Clybourn Ave., Chicago 14, Ill.



MITCHELL FIXTURE

Cable Tester and Locator

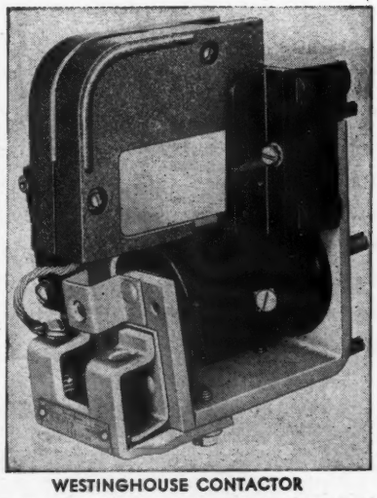


STEWART TESTER & LOCATOR

The Stewart cable tester and locator combined has many applications in the fields of industrial and utility engineering. In addition to locating shorts, crosses, grounds and wet spots the device locates buried cable or pipe and indicates the depth at which it is buried. Detector and neutral exploring coils, with head phones and lamp circuit, are included in the sturdy walnut-brown carrying case which weighs approximately 22 lbs. Locating the exact path and depth of forgotten pipes, water mains, river cable crossings, service feeders and telephone conduit provides important data when estimating excavation and regrading necessary for replacement, repair or removal of buried lines. W. C. Dillon and Co., Inc., 5410 W. Harrison St., Chicago 44, Ill.

Magnetic Contactor

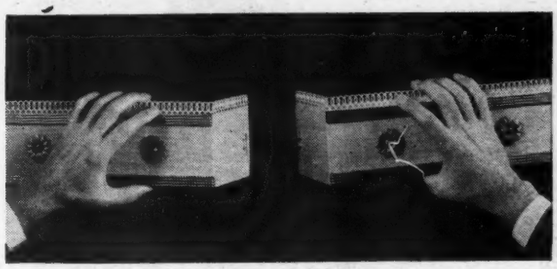
A compact, magnetic, d-c, single pole contactor is designed for heavy duty in limited spaces. This Type M unit can be had with rear or front connections. Assembly is on a formed frame which serves as the path for magnetic flux. Two frame constructions are available: one for applications where coil and interrupted circuit voltages are below 250 volts, the other suitable for ratings up to 600 volts. Operating coils are rated for continuous duty and will operate the contactors at 80 to 110 percent of their rated voltage. Westinghouse Electric Corp., Box 868, Pittsburgh 30, Pa.



WESTINGHOUSE CONTACTOR

Add-a-Light Fixture

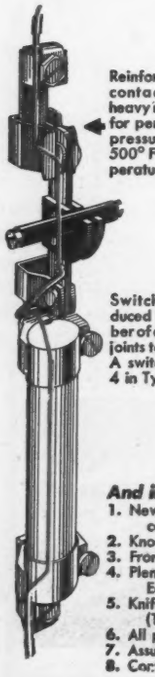
This fluorescent fixture of baked white enamel may be used as a self-contained unit or, by virtue of built-in male and female plugs, may be joined with other strips to extend the lighting facilities for any desired length. Shields and reflectors are available in metal, glass or plastic so that architectural harmony can be obtained in the home. The female plug can take the connection of another strip or can be utilized as an outlet for electric razor, hair curler or vibrator. Mounting is by picture hooks or wood screws. Moe-Bridges Corp., Sheboygan, Wis.



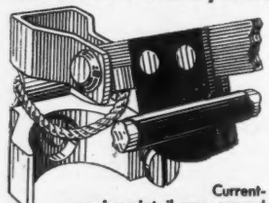
MOE-BRIDGES FIXTURE

A *New* AND *Better* SAFETY SWITCH

Features of the new and better C-H Safety Switch



Reinforced stationary contact jaws have heavy non-ferrous clips for permanent contact pressure. Withstand 500° F operating temperatures.



Current-carrying pigtail goes around hinge so that latter carries no current. A feature promoting better operation and longer life in Type A switches.

Switch heating reduced by cutting number of current-carrying joints to only 3 in Type A switches . . . to only 4 in Type C.

Perfected arc snuffer confines arc to restricted space and wipes remaining arc from blade as switch is opened. Snuffer readily removed to inspect jaw contact.

And in Addition . . .

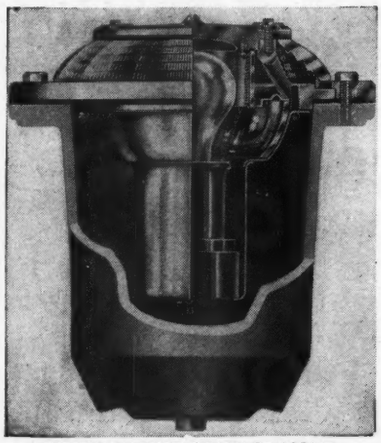
1. New modern case design that matches Cutler-Hammer motor control styling.
2. Knockouts that really knock out.
3. Front operation for close ganging.
4. Plenty of room and easy access to shape up wires inside. Easy installation.
5. Knife type blades, solderless lugs, screw type fuse clamps (Type A), strong clips.
6. All parts cadmium plated against corrosion.
7. Assured positive and firm contact even after long use.
8. Contacts on Type A switches are silver plated.

To beat the heat that *all* safety switches generate while they are "on" . . . Cutler-Hammer Engineers designed a NEW Safety Switch. Their first step was to plan a switch mechanism that would carry its load with a new low minimum of heating. Their second step was to build the mechanism so that it would far better withstand the heat produced by the fuses in normal operation. Finally they added plus features which a thorough investigation over a long period of time showed that contractors, electricians and service men want.

The result is an outstanding switch that offers better performance, longer life, easier installation, better appearance, a new measure of safety . . . a switch such as you have never encountered before. Why don't you take the measure of its quality in your very next installation? At Cutler-Hammer wholesalers everywhere. CUTLER-HAMMER, Inc., 1306 St. Paul Ave., Milwaukee 1, Wisconsin.

CUTLER·HAMMER
SAFETY SWITCHES
C-H

Airport Runway Contact Light



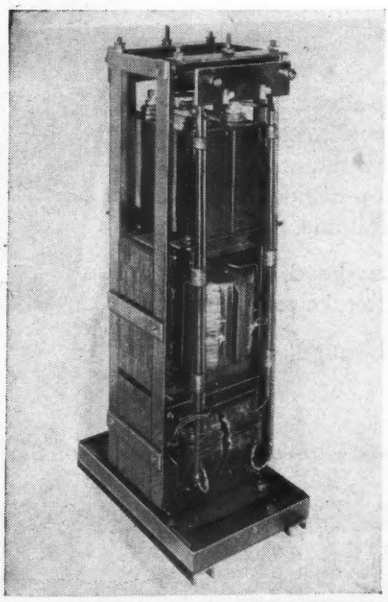
WESTINGHOUSE CONTACT LIGHT

A contact light for airport runways, designed to carry loads imposed by taxiing planes, measures a foot in diameter and projects above ground 2¾ in. It is interchangeable with Army - Navy standard mounting dimensions, gives a higher light output, meets all Army-Navy-CAA specifications and carries a dead load of over 50 tons. It is claimed that this is sufficient to support a Liberator or fully loaded Fortress bomber and is equivalent to the stress imposed by a 200,000 lb. plane taxiing over it during take-off or landing. A high strength, steel alloy, cantilever frame supports the load while the lens floats on synthetic rubber gaskets. Although the lens is heat treated to withstand severe impact, it is also designed to shatter into minute particles on breaking, leaving no sharp edges to slash tires. Westinghouse Electric Corp., Box 868, Pittsburgh, Pa.

Carbon Brush Mix

Grade 4029 is a new carbon brush mix designed for high speed industrial motors and generators. Both standard single-piece brush and "multiflex" construction utilize this carbon claimed to combine high stability and service with reduced commutator wear and maintenance. Speer Carbon Co., St. Marys, Pa.

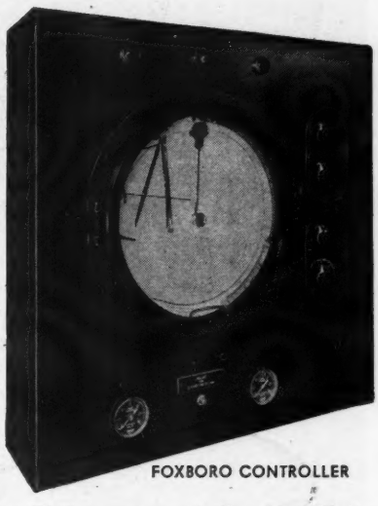
Constant Current Regulator



MODERN CONTROL REGULATOR

A standard 10 kw. dry type, static, constant current regulator using a compensated resonant circuit has been designed to hold currents constant in highway or airport series lighting. It is claimed that the equipment maintains unity power factor for all loads, doubles lamp life, operates in any position, has a built-in lighting ground and creates no radio interference. The manufacturer states that arc, mercury and sodium lamps may be operated on the same circuit without hunting. Flashing and dimming of lights can be effected through the unit and any combination of lights may be turned off without affecting the remaining lights. When located indoors the housing consists of heavy gauge steel; when outside, a waterproof and dustproof metal case with cast iron top is available. An automatic safety switch protects the equipment against open circuits. The 10 kw. unit weighs 580 lbs. and measures approximately 40 in. high, 20 in. wide and 14 in. deep. Material and workmanship approved by AIEE specs and NEMA standards. Modern Control Equipment Co., 176 W. Adams St., Chicago 3, Ill.

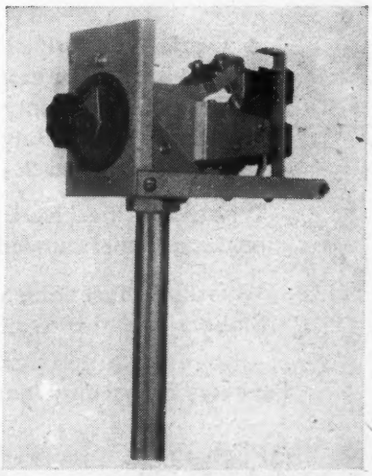
Cyclelog Controller



FOXBORO CONTROLLER

Not only can desired temperatures be obtained and held in a fixed range, but the rate of temperature increase or decrease in obtaining these levels can be regulated by the Cyclelog controller. Regardless of climatic conditions any predetermined thermal point can be reached at a regulated rate of change of from 1 to 8 degrees F. per min. On reaching the selected level the temperature will be held constant for the correct period. The unit will then automatically shut off the heat supply and will signal the operator, notifying him of the completed cycle. A revolving time chart and pivoted indicator permanently records the time-temperature variations throughout the entire cycle. Exact duplication for similar batch type processing is possible. Recording or logging the variations of a complete cycle suggests the name of Cyclelog. The Foxboro Co., Foxboro, Mass.

Temperature Control Switches

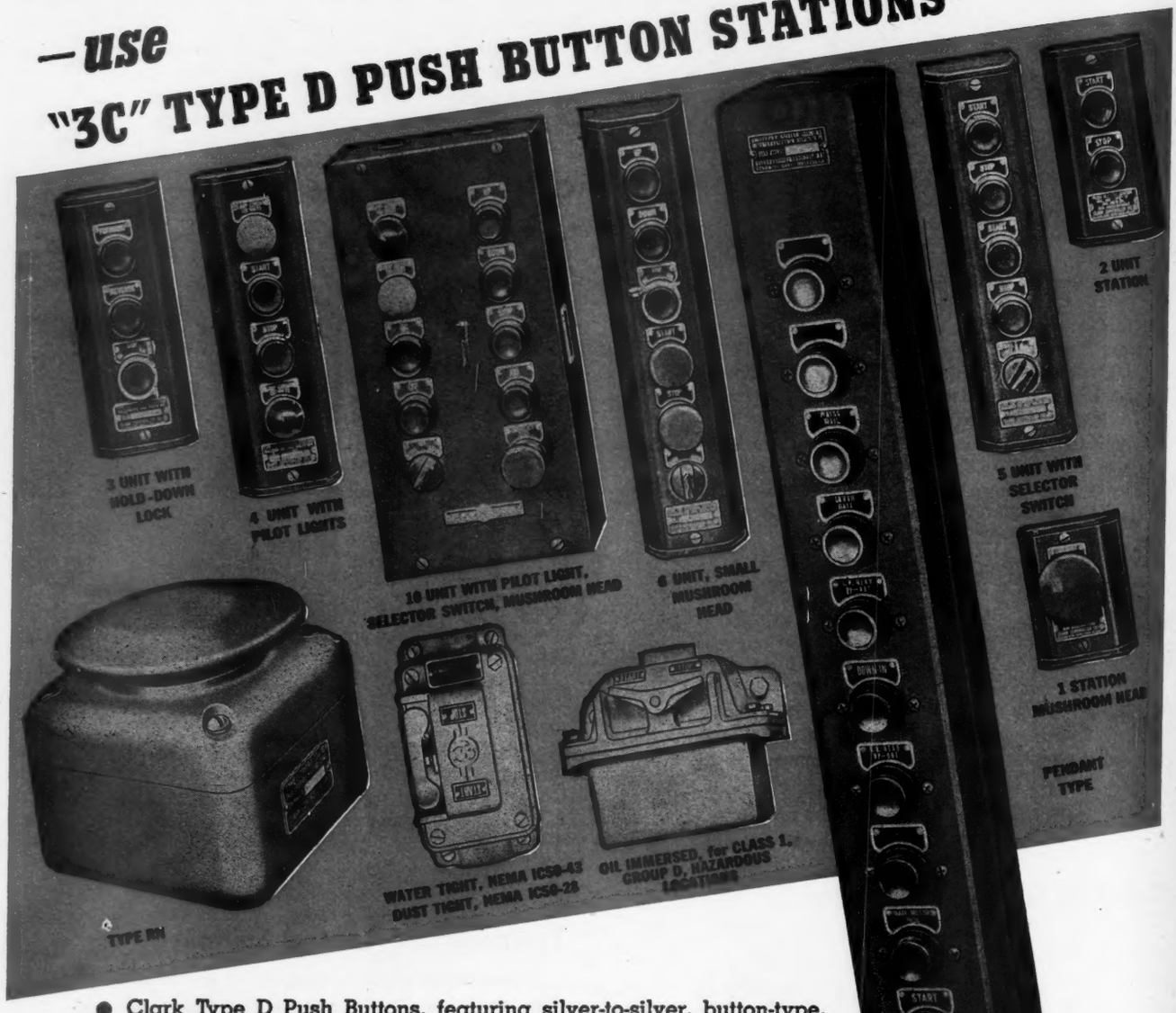


BURLING SWITCH

Temperature controls are available in either one, two or three-switch models and are recommended by the manufacturer to give control to variable speed motors. Dial pointers and lock screws permit fixed temperature settings over an adjustable range up to 700–1000 deg. The maximum differential between switches is approximately 150 deg. while the operating differential is plus or minus ¼ to 25 deg. All models (E1, E2 and E3) are equipped with either sheet metal or vapor-tight cast iron covers. Burling Instrument Co., 253 Springfield Ave., Newark, N. J.

IF you want to "START" something

—use "3C" TYPE D PUSH BUTTON STATIONS


3 UNIT WITH HOLD-DOWN LOCK
4 UNIT WITH PILOT LIGHTS
10 UNIT WITH PILOT LIGHT, SELECTOR SWITCH, MUSHROOM HEAD
6 UNIT, SMALL MUSHROOM HEAD
2 UNIT STATION
5 UNIT WITH SELECTOR SWITCH
1 STATION MUSHROOM HEAD
PENDANT TYPE
TYPE RN
WATER TIGHT, NEMA ICS0-43
DUST TIGHT, NEMA ICS0-28
OIL IMMERSED, for CLASS 1, GROUP D, HAZARDOUS LOCATIONS
START
STOP

● Clark Type D Push Buttons, featuring silver-to-silver, button-type, double-break contacts, bakelite insulating parts, large electrical clearances, and plenty of wiring space, provide low maintenance and long life in heavy duty operations. Push button stop is independent of contacts. 1½" and 2¼" mushroom heads are available.

Type RN—the "ROUGHNECK"—has mushroom head, cast metal enclosure with rounded shoulders sturdy enough to take rough usage.

Watertight, dust tight, and oil-immersed types can be supplied. Pendant Stations are also available.

For every heavy duty industrial push button application there's a "3C" Push Button Station available.

THE CLARK CONTROLLER CO.

1146 EAST 152nd ST., CLEVELAND 10, OHIO • OFFICES IN PRINCIPAL CITIES

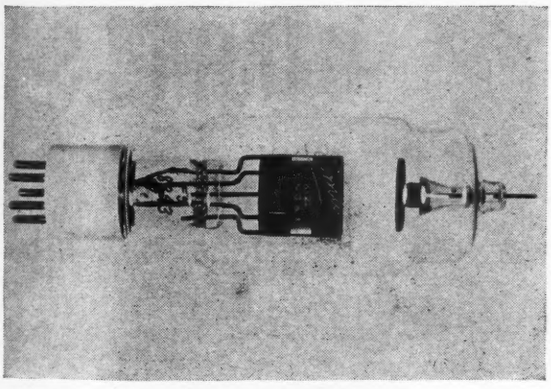
Remote Control Switches

STEVENS-ARNOLD SWITCH

Either wire or radio may act as a carrier medium for these frequency controlled tuned relay switches, factory adjusted for a selected band in the frequency range of 20 to 800 cycles per sec.; this range proving adequate for the control of many switches on a single circuit. The vibrating reed principle, hermetically sealed, is used for frequency selection and rejection by these units rated from 1 to 10 amps., 115 volts a-c. In radio application sensitivity permits control from either a crystal detector or a vacuum tube type receiver. Stevens-Arnold Co., 22 Elkins St., S. Boston, Mass.

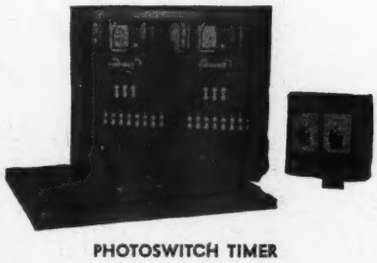
Mercury Vapor Rectifier Tube

A new grid control mercury vapor rectifier tube type KY21A/KY21 is announced. It combines sturdy construction with sound engineering, resulting in an efficient rectifier and power control tube. The peak plate current is 3 amps. while the filament current is 10 amps. Filament voltage is 2.5 volts and peak inverse voltage is 11,000 volts. Eitel-McCullough, Inc., San Bruno, California.



EITEL-McCULLOUGH TUBE

Repeat-Cycle Timer



PHOTOSWITCH TIMER

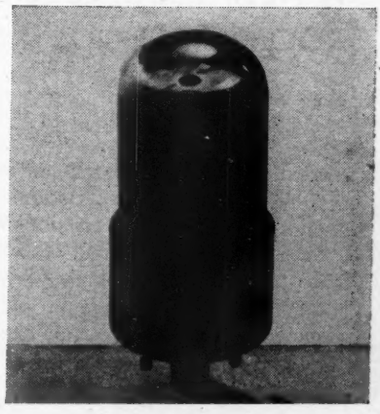
Timer Type 2T15U is an industrial electronic repeat cycle control designed for machinery and process applications operating on two alternate continuous periods. The periods, adjustable from 1/20 sec. to 2 min., are controlled by time elements and timing switches. Main intervals may be varied by snapping a timing element (6 sizes) into a clip on the front of the controls and adjusting to exact limits by means of auxiliary switches mounted either on the timer itself or in an individual housing at a more convenient location. A variation accuracy of 2 percent is claimed for these controls activated by either momentary or sustained contact and operating from either a-c or d-c at 115 volts. Photoswitch Incorporated, 77 Broadway, Cambridge 42, Mass.

Magnetic Pillow Speaker

TELEX MAGNETIC SPEAKER

Individual radio reception can be enjoyed without disturbing the reading or sleeping of a person a few feet distant. An electro magnetic sound generating speaker, hermetically sealed in a smooth plastic case, is available. The sensitivity is such that 5 milliwatts input is sufficient for sound reproduction through a pillow in a relatively quiet room although, in neighborhoods where general high noise levels demand, the unit will handle inputs in excess of one watt without distortion or harm to the vibrating system. The speaker, less than 4 inches in diameter and 1⅜ inches thick, weighs 5 ounces and comes equipped with a 10 foot cord. Its impedance is unaffected by temperatures or humidity and is guaranteed by the manufacturer to be shockproof and waterproof. Minor internal modifications change the speaker into a recording microphone suitable for outdoor use in rain, snow or hot sun. Telex, Inc., Minneapolis, Minn.

Cold Cathode Recorder Tube



SYLVANIA TUBE

A modulator glow tube of the crater type is presented for facsimile and sound-on-film recording, stroboscopic devices and photo-electric counters. The tube provides a modulated, high intensity point-of-light source by means of a hollow cathode producing high ionization density which may be viewed in depth. Type R-1130 recording tube is supplied in T-9 bulb with intermediate shell octal base and may be operated in any position. Providing a useful light range between 3500 and 6500 angstroms it will respond to frequencies between 15 and 15,000 c.p.s. Rated at 135 volts d-c with currents ranging from 5 to 35 ma., it requires a starting voltage of 170 d-c max. Sylvania Electric Products Inc., Boston, Mass.

ANNOUNCING

THE "Forty-Sixty"

...by CURTIS

A NEW FLUORESCENT UNIT DESIGNED FOR USE IN OFFICES, DRAFTING ROOMS, SCHOOL ROOMS, ETC.

It's new . . . It's Alzak Aluminum . . . It's the means of opening up new fields for profitable sales!

The "Forty-Sixty," Catalog No. 4060, directs approximately 40% of the light upward, 60% downward. It is specifically designed for lighting jobs requiring an indirect component and is ideal for office, drafting room, and school room installations.

The "Forty-Sixty" is characterized by low fixture brightness which results in pleasant, comfortable seeing conditions and avoids wastage of useful light.

Ideal for use as individual units or continuous lines. This unit provides comfortable lighting at its best. An all metal unit, maintenance is at a minimum.

Go after the market now opened up for you . . . write for complete data and technical details today.

CURTIS Lighting INC.
6135 WEST 65th STREET
CHICAGO 38 • ILLINOIS

Sun Switch Light Control

RIPLEY LIGHT CONTROL

Street lighting and the illumination of public buildings, airports and outdoor advertising can be automatically switched on when the intensity of natural lighting falls to a predetermined level. Each electronic Sun Switch incorporates a standard amplifier tube, photoelectric cell and relay with long-life tungsten alloy contacts. The rustproof housing has an overall length of 9¾ inches and a diameter of 4⅛ inches. A swivel bracket on the 4½ lb. unit permits rotating the photo cell to receive north light. Operation of the switch is independent of fluctuations in twilight and normally is adjusted to provide illumination from 25 mins. after sunset until 25 mins. before sunrise. Local conditions and customer requirements can vary these limits. The Ripley Co., Torrington, Conn.

Splatter-Proof Heat Ray Lamp

WESTINGHOUSE LAMP

A 250-watt, R 40, infra-red heat ray lamp has been designed to resist breakage when subjected to the shock of cold water spray. The bulb, which can be screwed into a standard voltage household light socket, has an overall length of 6⅞ in. and a diameter of 5 in. The lamp can be used for drying small articles, in industrial or domestic operations, for spot warmth comfort and for therapeutic purposes. A self-contained reflector is hermetically sealed in the bulb. Westinghouse Electric Corp., Bloomfield, N. J.

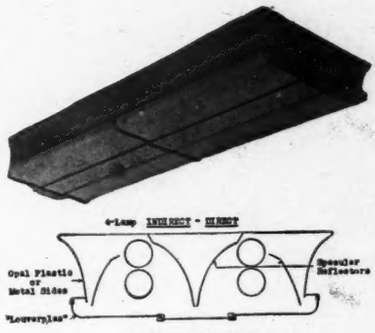
Air Drying Varnish

A black oilproof flexible varnish with a slow initial set is applicable for uniform coverage by brushing, dipping and spraying. The wet dielectric strength of this Number 238 varnish is 600 volts per mil while the dry dielectric is 1300 volts per mil. In addition to its oilproof quality it has a high degree of resistance to both fresh and salt water. Mineral spirits (turpentine substitute) may be used for thinning purposes. Though not a baking varnish, many baking qualities may be gained by air drying for a period of 6 hours. John C. Dolph Company, 168 Emmett Street, Newark 5, N. J.

Magnetic Adjustable-Speed Drive

A magnetic adjustable-speed drive provides rapid control and wide-range regulation for draft fans, blowers, compressors and centrifugal pumps. The unit consists of a rotating ring and magnet and is a compact, self contained, electro magnetic torque transmitter in combination with a constant speed a-c motor. An electronic controller offers exact speed selection. Ratings vary up to 25 hp. and speeds from 1800 to 600 rpm. Choice of equipment presents combinations for both new and existing installations. The manufacturer claims that equipment life is increased and power consumption reduced by allowing the drive to cut blade speeds when local demand permits. The drive, used in combination with synchronous motors, provides power factor correction. Electric Machinery Mfg. Co., Minneapolis 13, Minn.

Axial Plane Fluorescent Fixture



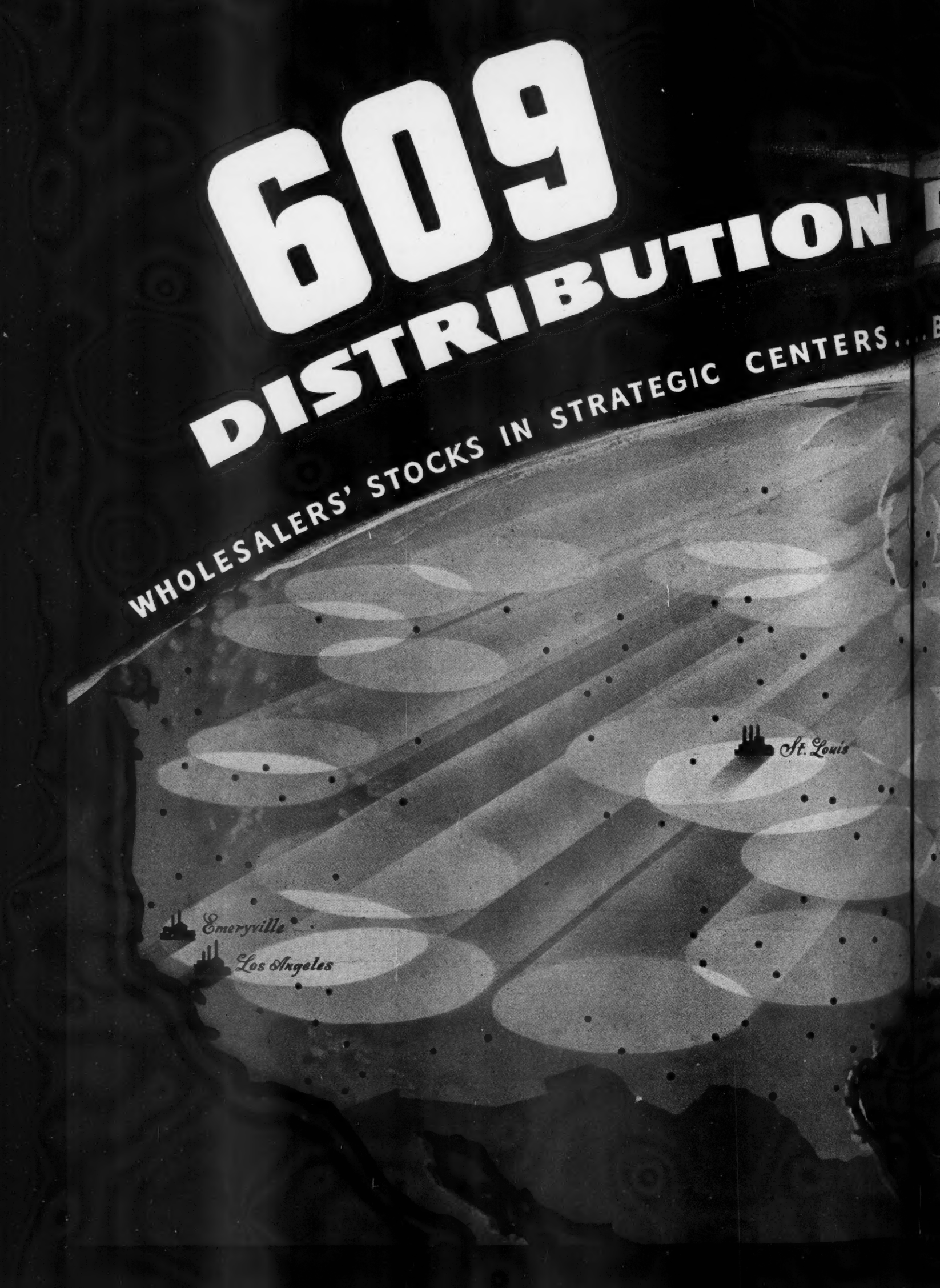
DOANE FIXTURE

Two double tiers of fluorescent tubes, specular reflectors and louvered plastic shields are features of a "Tamdenlamp" fixture. The assembly of lamps and reflectors is designed to direct a greater percentage of uninterrupted reflected light through the shield. The sheets of "Louverplas" combine a series of closely-spaced translucent louvers separated from one another by clear plastic traversed by minute prisms. High efficiency, glareless directional lighting is claimed by patent-holding Doane Products Corp., Meriden, Conn.

Vertical Dripproof Motor

CROCKER-WHEELER MOTOR

A vertical dripproof a-c motor rated at 40 C rise continuous duty with a 15 percent service factor is designed for operation from 60 or 50 cycle, three or two phase circuits at all standard voltages. Vent openings are shielded against dripping liquids and falling particles and a recessed junction box provides ample room for making electrical connections. Oversize ball bearings carry thrust in addition to the rotor and a patented centrifugal bearing seal permits the use of softer greases. Crocker-Wheeler Division, Joshua Hendy Iron Works, Ampere, N. J.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WHOLESALERS' STOCKS IN STRATEGIC CENTERS
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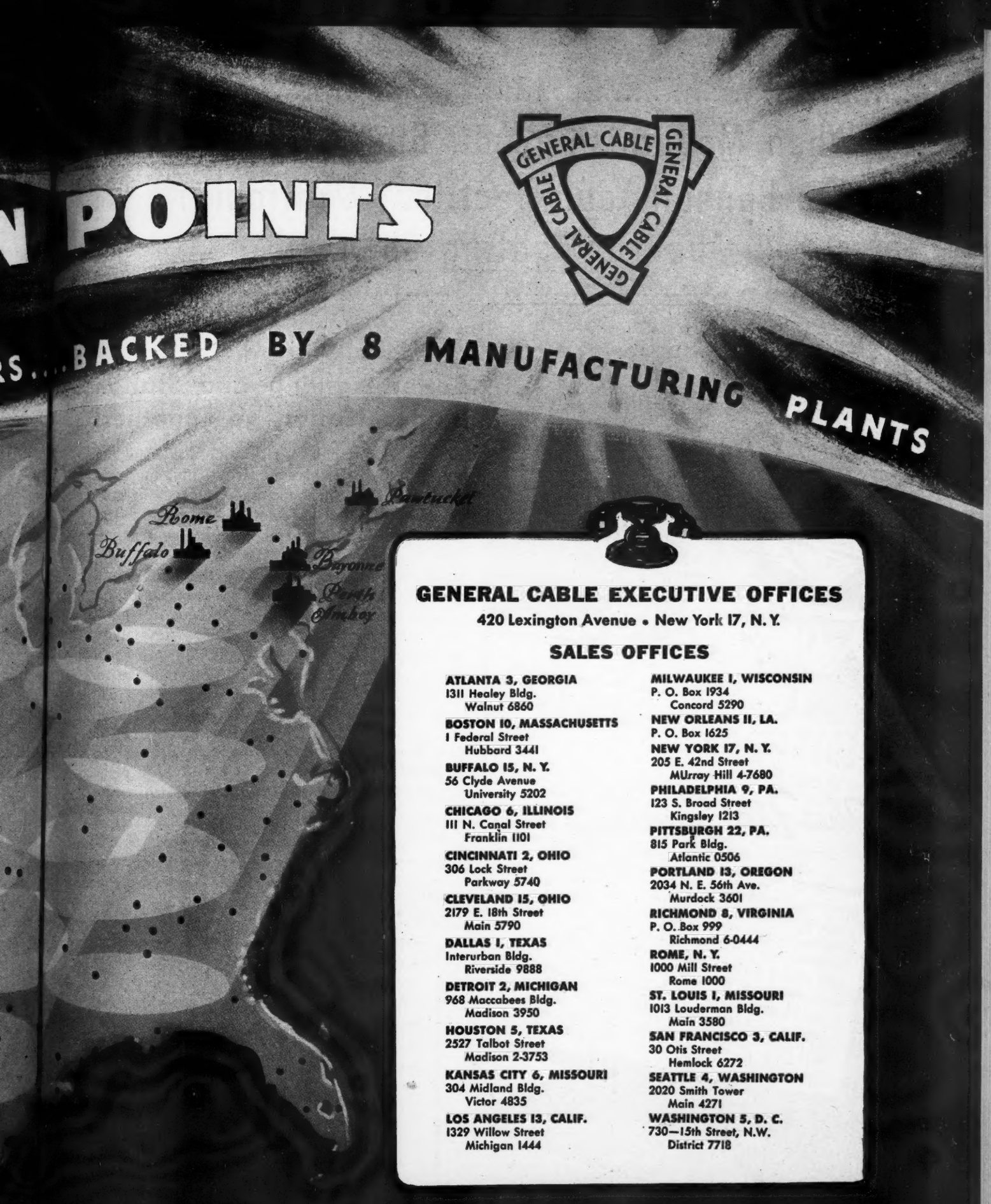

GENERAL CABLE EXECUTIVE OFFICES

420 Lexington Avenue • New York 17, N. Y.

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Franklin 1101

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Parkway 5740

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Riverside 9888

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Madison 3950

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MUrray Hill 4-7680

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Atlantic 0506

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Murdock 3601

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Richmond 6-0444

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Rome 1000

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Hemlock 6272

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GENERAL CABLE
CORPORATION

When Modernizing Your Station, Be Sure to Consult Your Electrical Contractor About a Lighting Checkup

INTERNATIONAL
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Exposition
and conference
SEE THE LATEST IN LIGHTING
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WRITE FOR FREE BULLETIN ON HOW TO TIE IN WITH THE NEW BENJAMIN SERVICE STATION LIGHTING PROGRAM
BENJAMIN
SPOTLIGHTS THE BUILDINGS
FLOODLIGHTS THE GROUNDS
1345

Like Oil and Gas... Better Lighting and Station Modernization go Together!

You can be sure that if your station needs building modernization, changes in layout, building additions or new parking facilities, it needs lighting modernization too! For Modernization and Better Lighting are like gas and oil . . . they go together!

To make sure you get station lighting that will be in step with your modernized buildings and grounds, CONSULT WITH YOUR LOCAL ELECTRICAL CONTRACTOR. By training and experience, he is fully qualified to survey your needs and make recommendations. Depend upon him and you'll insure against disappointment . . . you'll be assured lighting that is up-to-the-minute . . . efficient, economical and easy to maintain!

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Here in this 52-page booklet have been gathered together the cream of the suggestions for station modernization! Hundreds of pictures of stations inside and out. Floor Plans, Business-Getting Ideas . . . the very latest ideas in station planning! YOU'LL WANT THIS BOOK FOR PERMANENT REFERENCE! YOU'LL WANT THIS BOOK to make sure you're doing everything possible to ATTRACT MORE TRADE AND MAKE MORE PROFITS.

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BENJAMIN ELECTRICAL MFG. CO., Dept. H, Des Plaines, Ill.

BENJAMIN TRADE MARK

SERVICE STATION LIGHTING and *Floodlighting* EQUIPMENT

Distributed exclusively through electrical wholesalers

High Frequency Heating—III

The economic, installation and maintenance phases of induction heating equipment is discussed in this third article of the series.

By Dr. H. B. Osborn, Jr.
Director of Research, TOCCO Division
The Ohio Crankshaft Company
Cleveland, Ohio

IT would be obvious to any one having a reasonable knowledge of induction heating equipment that many applications can be completed successfully with almost any frequency. Economic limitations, however, must not be overlooked. Of outstanding importance is the fact that the motor-generator frequencies are obtainable at lower cost per kilowatt than either the spark gap oscillator or the vacuum tube oscillator (Fig. 1). This is true at low power

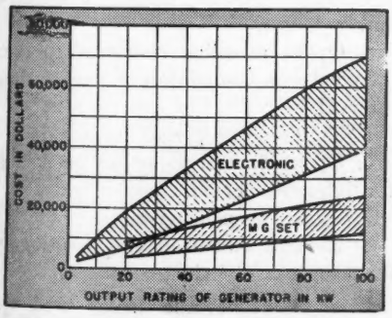

FIG. 1—Equipment cost comparison per kw. output between electronic and motor-generator high frequency generating units.

ratings and as the kilowatt output increases, the cost per kilowatt decreases with the motor-generator unit, whereas with the other two types it remains substantially the same (Fig. 2). In other words, an installation involving 2000 kw. of high frequency equipment would run approximately $100,000 with a motor-generator unit, but would be close to $500,000 with vacuum tube oscillator equipment or even spark gap equipment, if such a large unit were manufactured.

Space requirements are of importance, with the lower frequency units again being the more desirable. A 200 kw. motor-generator set would be approximately 2 ft. by 2 ft. by 5 ft. in size, whereas a 100 kw. tube oscillator would require a room at least 10 ft by 20 ft. by 10 ft. due to spacing limitations of the equipment in the circuit.

Cost Analysis

When considering the purchase of induction heating equipment one may well be guided by the slogan, "Why heat the whole piece?" For example, the production of bearing surfaces on a large assembly by conventional methods would necessitate heating of the entire part for quenching and drawing or carburizing and hardening. In the latter case, copper plating or removal of excess stock might also be needed. With induction heating, however, it is possible to machine the part completely and then merely harden the required areas. Costly pre-treatments as described are eliminated as are straightening operations. In general, it is a fairly safe estimate that induction hardening costs, including power, labor, and overhead, run considerably less than one cent per pound which compares very favorably with furnace methods. It is admitted that it is more expensive to develop a B.t.u. of energy in a piece of metal with electrical energy than with gas or other types of fuel. But higher production, improved quality, and low labor charges throw the balance in favor of induction heating.

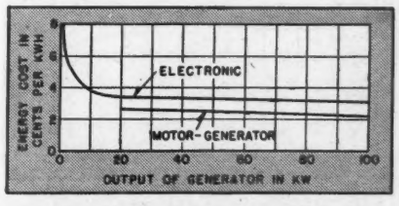

FIG. 2—H. F. Energy cost comparison per kw. output between electronic and motor-generator high frequency generating equipment.

Flame hardening is perhaps the only other method of heat treating which attempts to produce approximately the same type of product and is able to claim some of the advantages of induction heating. The inability of this process, however, to accurately enough reproduce results makes it quite undesirable in comparison with induction heating. Further, flame hardening costs, due to high labor charges and price of gas, are many times greater than induction hardening. Admittedly, the initial cost of induction heating equipment is considerably more than that of flame hardening units. However, the difference in the operating costs more than justifies the selection of the former. For example, one manufacturer making a particular sprocket showed a flame hardening cost of $1.25 per sprocket, this resulting from the use of an almost completely automatic setup, costing about $1,000. This equipment was replaced with an induction heating machine at a total cost of $20,000 but with a decrease in production cost to 25 cents per sprocket. With a production

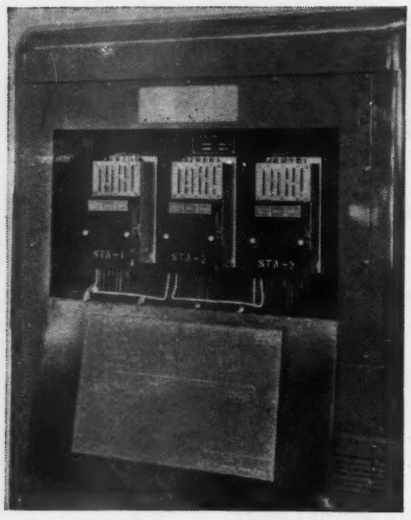

FIG. 3—Automatic timing control for a three-station induction heating unit. Timers control indexing (holding), heating and quenching periods for each station. Thumb screw adjustments permit quick change of time cycles.

rate of 800 sprockets per day at a saving of $1.00 per sprocket, the induction heating unit was soon paid for from these savings.

Continuous heat treating of bar stock wherein material is heated to hardening temperatures, quenched, and re-heated for drawing, producing an absolutely uniform product, shows so many advantages and economies that this will no doubt be a "must" for all steel mills in the country. Each bar is produced with a uniform microstructure throughout its entire length and cross section, and no conventional furnace has ever been built which could pick up a bundle of bars and heat and quench and draw each and every one uniformly at the same rate and to the same microstructure. There is no question about the quality comparison but the unusual thing is the fact that the overall heat treating cost with induction heating, including power, labor, and overhead, is only $15.00 a ton compared to $30.00 a ton now a standard charge for heat treating by all mills.

Holdover Consumption Eliminated

When considering induction heating equipment for forging applications, one must be willing to accept the fact that the installation cost of the equipment, as well as operating cost based on energy only, will be approximately three to four times that of a standard fuel fired furnace. However, induction heating makes possible the fuller use of available capacity of presses, upsetters, or forges by being able to keep a continuous stream of heated parts coming to the operator. Actual all-over operating costs are reduced if we consider that with induction heating, power costs are present only when material is being run—there being no holding of furnaces at heat while a press is down or dies being changed; no overheating or scaling during normal run or hold periods; no waste energy bringing the furnace up to temperature or allowing it to cool; no expensive ventilating system to improve working conditions which will be insisted upon by the workers; elimination of stand-by crews; accurate temperature control; and a minimum of floor space.

For estimating purposes, a factor of $15.00 per pound of metal heated per hour will serve to give some indication as to the cost of induction heating equipment to be used for heating for forging. This factor is based on heating steel to 2000° F. Further, operating cost for electrical energy is approximately $4.00 per ton per hour. Thus, for example, an installation suitable for heating one ton of stock per hour to forging temperature would cost approximately $30,000, and the operating cost of electrical energy would be $4.00 per hour. Complete mechanization of the unit would preclude the necessity for having any labor charge against the heating application since a press man is used for loading the magazine or hopper on the feeder to the induction heating assembly.

Induction Heating Equipment Control

It would be impractical to completely cover all the phases of the electrical controls used by the various manufacturers of induction heating equipment. Suffice it to say, however, all standard units and tooling used with same depend almost exclusively on electrical control circuits for producing desired temperatures, metallurgical results and other related goals.

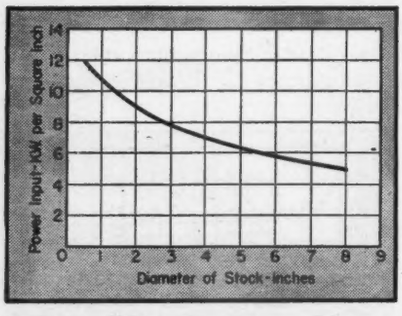

FIG. 4—Minimum power input per unit surface area for various diameters of stock necessary to maintain depths of hardness associated with the frequencies employed.

There are, however, a few mechanical devices introduced for various reasons.

Versatile Timing Controls

The mechanism by which the power is turned on and off varies with the type of circuit, but in general these will include a contactor of one or more contacts, in every case activated by an electrical timer. These timers are, for the most part, clutch operated, synchronous motor driven assemblies accurate to 0.1 second (Fig. 3). Such accuracy is adequate for most applications, although a few electronic controls have been introduced on some special machines for shorter cycling. These same timers are used with multiple circuits for operating indexing mechanism and a few other control items. For example, in the hardening of armor piercing projectiles, the multiple circuit timer performs the following operations after the "start" button has been pushed manually:

1. Elevates platform with armor piercing projectiles in position into inductor coil by means of solenoid-controlled hydraulic valve.
2. Closes mainline contactor for heating of shot.
3. At some pre-determined period during the heating cycle, closes contactor which adds additional capacitance in the high frequency circuit to re-adjust power factor.
4. Opens mainline contactor to turn off power on completion of pre-set time interval.
5. Times delay period for soaking.
6. Opens quench valve for quenching for required period.
7. Closes quench valve.
8. Returns shot to loading position by lowering out of inductor coils.

The same machine being used for processing of the above armor piercing shot will have more than one operating station so that by means of interlocking control systems the timer at Station No. 2 will automatically be started when the heat control circuit at Station No. 1 has opened.

As the temperature of an inductively heated bar increases, its electrical resistance increases also and the rate of heating as well as the power input diminishes. Associated with the decrease in power is a falling off of voltage. This is not too serious with short cycles, particularly with the vacuum tube oscillator. In the case of the spark gap oscillator, the inductor coil and the part being heated together have an external

FIG. 5—Forge shop setup showing completely sealed, water-cooled, motor-generator high frequency heating unit adjacent to hammer. Vacuum tube units not adaptable because of vibration. Above unit processed 2000 parachute snap hooks per hour.

inductance which is matched by tuning of the internal inductance of the set. Since the inductance changes with the resistance of the material, the rate of power input to the piece falls off rapidly and thereby the set quickly passes out of resonance. Only by re-tuning, and doing so continuously, can any semblance of good efficiency be maintained. Obviously, such a practice would be most impractical in production work and precludes the use of such equipment on large parts.

With the motor generator set, on the other hand, the capacitance of the high frequency circuit can automatically be readjusted during the heating cycle and power input to the inductor prevented from falling off too markedly. A more satisfactory expedient, however, is the use of a voltage regulator which, by adjusting the field excitation of the generator, maintains a constant voltage to the inductor which therefore holds the power input at a reasonably constant level. Obviously, if one has a 100 kw. machine in use, the most efficient operation is that which will permit the 100 kw. to be developed and introduce into a metallic part over the entire heating cycle thereby decreasing heating time and increasing production. Such controls as the addition of condensers and voltage regulation are used extensively in processing of parts with long heating cycles—such as heat treating armor piercing shot and heating of shells or slugs for forging and forming. Note, however, that where the operation is continuous and parts may be passed progressively through an inductor coil, such control is not necessary since the machine can be set up for efficient operation by pre-determining the correct capacitor setting and excitation. We wish to repeat that while we have mentioned long heating cycles, such an expression in terms of induction heating time means perhaps 50 or 60 seconds which, in comparison with conventional methods of processing, is still very short.

In a few cases, temperature control other than by regulation of power input and heating time is used with induction heating equipment. Thermocouples of various types are being used successfully, as are various types of radiation pyrometers. For hardening applications, temperature control is not considered necessary since a greater latitude in temperature is permitted with induction heating due to the short heating times which, in general, are but a few seconds. However, in heating of shells for forming or forging, or a reheat setup where the temperature of the shell at the time it is placed in the induction heater varies considerably from piece to piece, we are unable to set automatic controls for heating to a specified temperature since the introduction of a fixed amount of energy for a specified amount of time produces a uniform product only if the heat content of the material at the start is the same each time. Where this is not true, radiation pyrometers can be

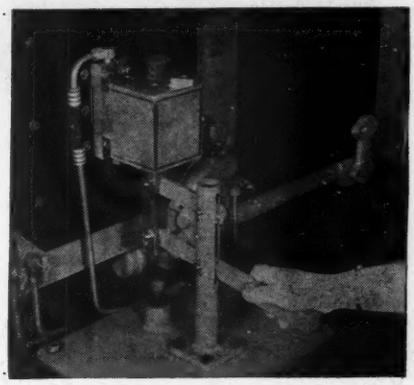

FIG. 7—Slugs are heated for forging operations in this typical induction heating unit. Slug is loaded manually and ejected by lever mechanism shown.

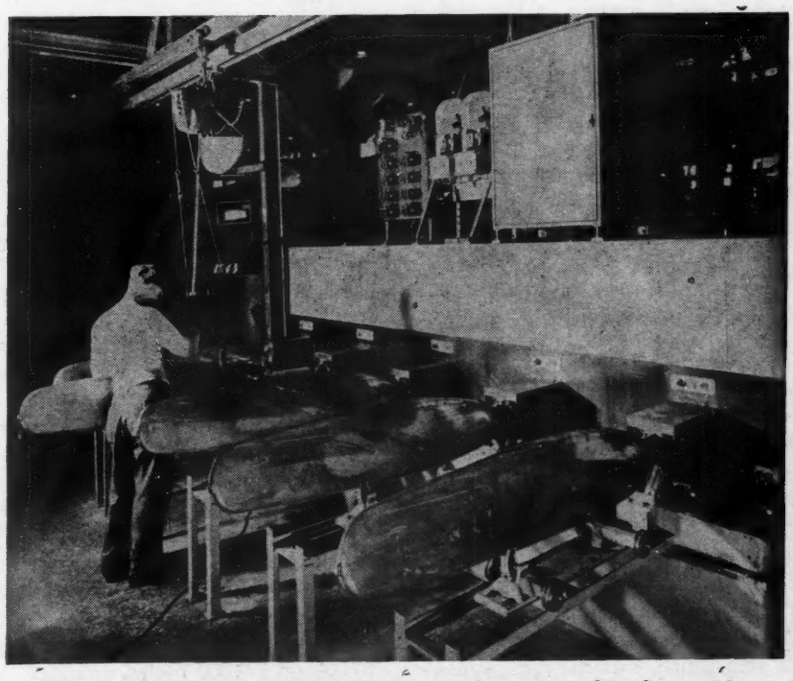

FIG. 6—Aluminum propeller blades are heated in this five-position induction heating unit for upsetting flanges. Some 80 blades per hour are heated to 950 degrees F. by this 200 kw., 3000 cycle installation.

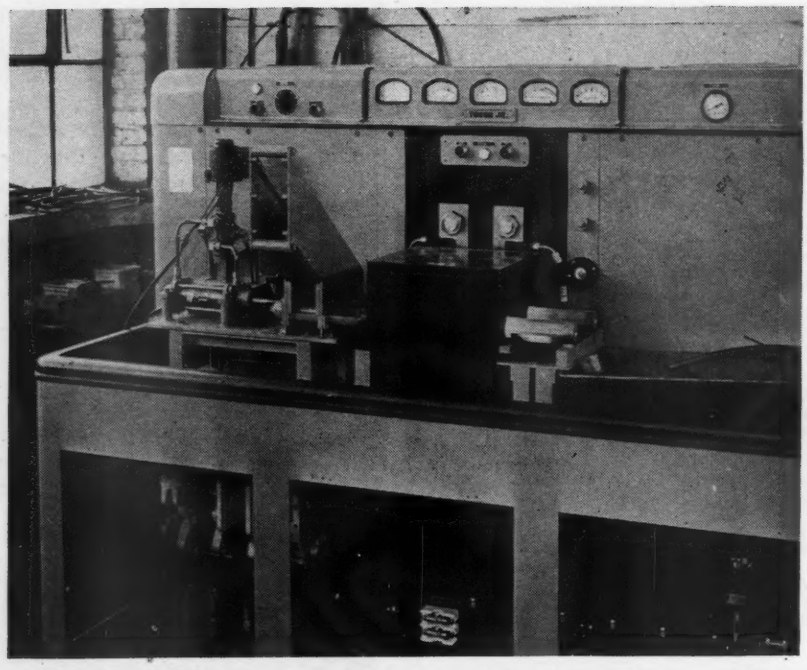

FIG. 8—10,000 Cycle motor-generator unit heats brass slugs to 1600 degrees F. in this hopper fed, double-line unit. Hydraulic cylinders push parts through inductor coil.

used which are connected through the control circuit and automatically turn off the power when the correct temperature is reached.

Processing Cycle Control Factors

Fullest advantage of the skin effect of high frequency heat is obtained only if the surface can be brought up to hardening temperature in a few seconds. Thus we must introduce a sufficient amount of energy into the inductor to induce adequate current in the surface of the zone to be heated. The power in the inductor is measured in kilowatts and we therefore speak of the power input in terms of kilowatts per square inch of surface area heated. Unless we maintain certain minimum values for this factor, flow of heat by thermal conduction will result in increase of depth of hardness.

By use of the data shown in Figure 4 we can determine the amount of energy necessary to harden the area on a certain part to the depth associated with the frequencies employed. The higher the frequency, the more important becomes this power per unit of area requirement.

Due to the difference in the rate of response of various metallurgical structures, the above factors can be used only as guides, but at least eliminate a lot of "cut and try." An additional factor necessary is that of approximately 35 kw. seconds per square inch of surface area which, with the factors obtainable from the above-mentioned chart, enables one to establish the amount of power and the number of seconds to be tried for producing a desired result. Obviously, metallurgical examination and hardness survey must follow to determine what adjustments, if any, are necessary. The prior structure affects final result due to differences in rate of solution of the micro-constitutents.

In through-heating of stock, energy conversions range from 5 to 15 lbs. per kilowatt hour, depending upon temperatures required. Progressive heating of tubing for annealing, heat treating, normalizing, brazing, etc., is the most efficient application for induction heating, and when the wall thickness approaches the same order of magnitude as the depth of penetration of electrical energy, our energy conversions are increased over the values given above.

There is a common misconception by many people that heating of non-magnetic materials requires the use of high frequency. We wish to point out emphatically that the *electrical characteristics of the material have no relation whatsoever to frequency.* That is to say, provided the diameter of the stock is such that it can be heated with the frequency employed, as discussed earlier, the conversion of kilowatts to B.t.u.'s is the same regardless of frequency. For example, ½-in. diameter slugs of brass are heated to 1500° F. in the same period of time, and with the same amount of energy, regardless of whether we use 10,000 or 500,000 cycles.

Several factors determine the operation of an induction heating unit—the resistivity and permeability of the material; its radius; and the frequency employed. Of these, frequency is the only one which can be changed if we are considering processing a given object. *The control factor is, however, one which has been identified as an Index Ratio, being equivalent to the radius of the charge in centimeters, divided by the radial dimension in centimeters of the depth heated inductively. This latter factor is equal to 50 times the square root of the reciprocal of the frequency at hardening temperature for steel or any temperature for non-magnetic materials.* In general, it is not considered advisable to operate where the Index Ratio value is less than 2.5. The efficiency of the transformation from electrical energy to heat increases with increase of frequency until the Index Ratio reaches this value, beyond which efficiency is not affected by further increase of frequency. Calculations will show, therefore, that where the material will respond to the frequency as mentioned above, non-magnetic materials or magnetic materials can be heated at the same energy conversions whether processed with motor-generator or vacuum tube oscillator equipment.

In making estimates as to the amount of energy necessary for various heating operations such as forging, forming, or brazing, the amount of metal to be processed, temperature required, and production rates are to be considered. For example, when heating to forging temperatures of say 2000° F. to 2200° F., a factor of 5 lbs. per kilowatt hour

FIG. 9—Ring gears are shrink fitted to flywheels by induction heating. Inductor coil is mounted with hydraulic cylinder which presses gear to wheel after expansion. Subsequent quench shrinks gear in position.

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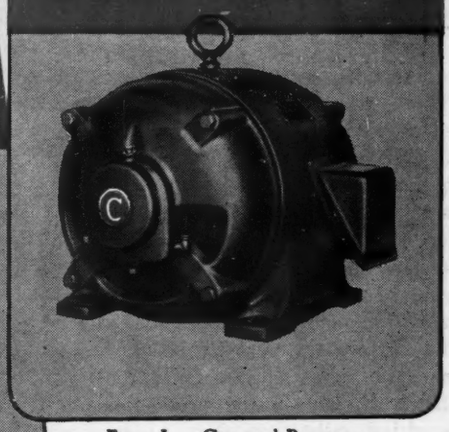

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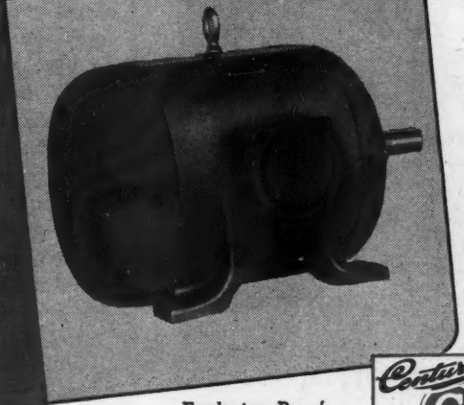

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(high frequency input to the inductor) is used, and is relatively conservative. Thus, for heating of billets for forging at the rate of 500 lbs. per hour, an induction heating unit would be recommended with a capacity of 100 kw. For heat treating operations involving through-heating from 1450° F. to 1650° F., a factor of 8 to 10 lbs. per kilowatt hour will serve for estimating purposes. Similarly, for heating for brazing with alloys flowing at approximately 1200° F., estimates based on 15 lbs. per kilowatt hour are sufficiently accurate. In every case, however, one must not overlook the fact that if the volume of metal to be heated is a part of a larger assembly, some allowance must be made for the flow of heat away from the area being processed. This can be done by assuming more metal will be heated to brazing temperature or by adjusting the conversion factor downward.

Installation and Maintenance

Due to the high operating voltages of spark gap and vacuum tube oscillator equipment, these units are for the most part installed where the heating operation is required. This is also done with the motor-generator sets since all three types of machines are built into compact, completely self-contained assemblies. Therefore, they can be considered much the same as a machine tool and placed directly in the production line requiring only that they be serviced with power, water, and drain. The power supply is relatively unimportant since the manufacturer of the induction heating equipment can make provisions for accommodating standard plant lines. All induction heating units up to approximately 30 kw. output are of sufficiently small size and weight that they can be mounted on movable dollies if there is any particular advantage in doing so. *Vacuum tube oscillators must not be installed close to presses or hammers which will jar the tubes.*

One outstanding advantage unique with the motor-generator equipment, however, is that the inductor coil and accompanying condensers can be mounted hundreds of feet away from the main unit, making it possible to install a single large motor-generator unit for energizing a large number of heating stations scattered throughout a plant. This is possible because of the low operating voltage of the generator which, for sizes up to 200 kw. runs either at 220 or 440 volts; and for sizes above 200 kw., 800 to 1000 volts. Transmission of generator frequencies at these voltages is accomplished by using busbar, coaxial cable, or standard four conductor cable with the two opposite lines tied together.

Water is required for cooling of all the inductor coils and other electrical equipment such as condensers and transformers. Some of the vacuum tube oscillator units use air-cooled tubes, although many require water cooling. *In any case, proper insulation is used on all lines inside of the machine carrying water, to prevent condensation and consequent damage to electrical equipment from the water which would of necessity drip from the lines.*

The dirt generally found in most plants can become a serious problem with induction heating equipment. Despite filter systems and the precautions taken by many manufacturers, *dirt finds its way into the high frequency units producing shorting and arcing of the condensers, breakdown of the spark gaps, and burning out of the generators.* The manufacturers of generator equipment, however, have recently developed a completely water-cooled unit which makes it possible to seal up the entire induction heating machine so that such a unit can be installed in the most unfavorable of plant locations—such as alongside of carburizing furnaces, and in forge shops of all types (Fig. 5).

The motor-generator units used in the completely self-contained machines are all mounted on heavy cast iron bases, do not require any special insulation and can be set directly alongside of forging presses or hammers without any concern for vibration. Naturally, standard dampeners and mountings are provided as a precautionary measure. Where heating requirements are sufficient, however, to warrant a large generating unit, this is usually located in a separate room which can be isolated and kept clean. Although of no particular importance to the water-cooled generators, it permits the use of open-type construction on the accessory control panels and starters.

Generally speaking, only with heavy forging units is vibration a problem which would prevent the installation of the more delicate vacuum tube oscillator equipment. However, since forging work is generally better served with a motor-generator machine on moderately small diameters, and absolutely necessary on heavy sections, this problem is very seldom encountered.

All induction heating equipment is provided with interlocking devices for protection of the operators so that no hazards are involved. Spark gap oscillator equipment and some of the vacuum tube equipment operates without adequate output transformer voltage reduction, and there is a danger of shock to the operator. With the motor-generator, this is not true since even its low voltage is further reduced to the order of some 20 to 60 volts before entering the inductor. Some manufacturers of vacuum tube oscillator units use similar

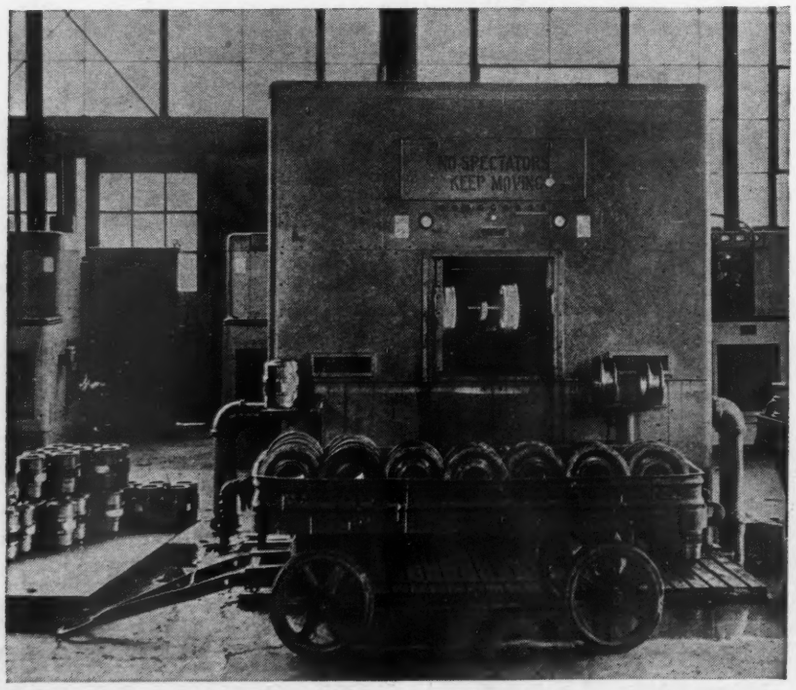

FIG. 10—Single operation induction heating unit surface heats track roller flanges to hardening temperature and shrink fits them to hub.

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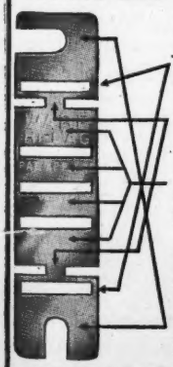

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voltage reduction so that the inductor coils can be touched even while the power is on without any danger of shock.

All spark gap oscillator equipment depends for its efficient operation on the adjustment of the spark gaps and it is necessary to re-set these periodically. With normal use, this readjustment must be made every 50 hours, and to do a good job requires at least two hours. No adjustment is necessary on vacuum tube oscillator equipment or motor-generator sets and neither of these two units is as susceptible to overload conditions and breakdown as the spark gap unit which, because of its circuit, cannot have built into it the same type of overload protection.

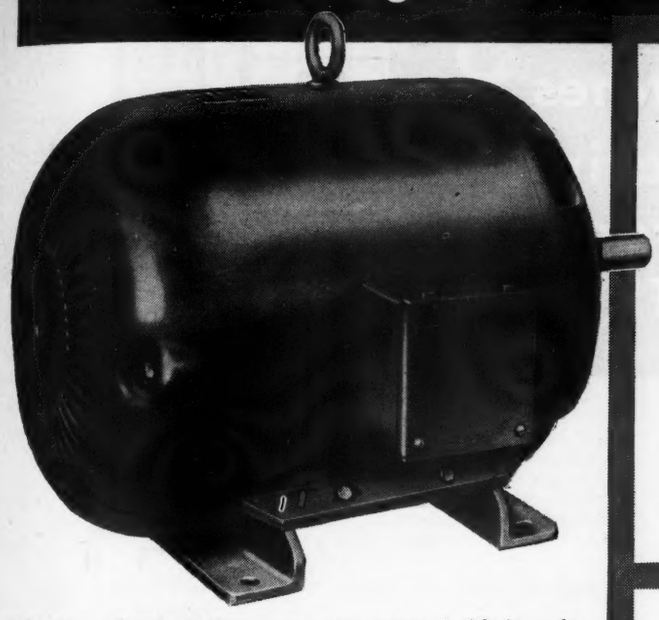
There are several very important precautions in maintaining induction heating equipment in satisfactory condition. These may be briefed as follows:

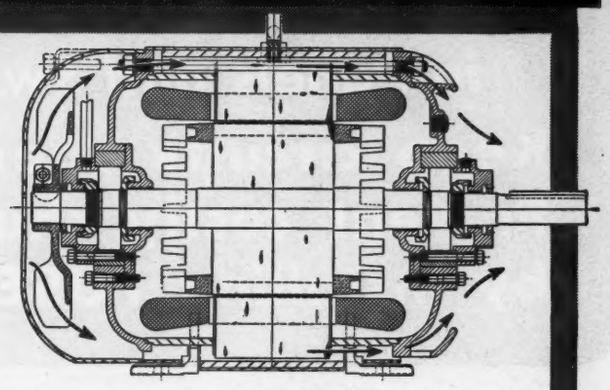
1. Never operate the unit without all cooling water being turned on as specified by the manufacturer. Protective devices are furnished.
2. Do not operate equipment in excess of rated power output even for short periods of time, if you expect good service.
3. Do not allow dirt to accumulate in any part of the equipment since this will eventually result in breakdown.
4. Clean and replace all filters as specified by manufacturers.
5. Oil all moving parts with material specified by manufacturers, and at intervals indicated by them.

With labor costs at their highest level and willingness to work at the lowest in the history of high productive manufacturing industries, the only chance for a return to prewar price levels will be through the adoption of processes and techniques which will reduce the man hour and material charges per unit or per assembly manufactured. Induction heating will fill such a need.

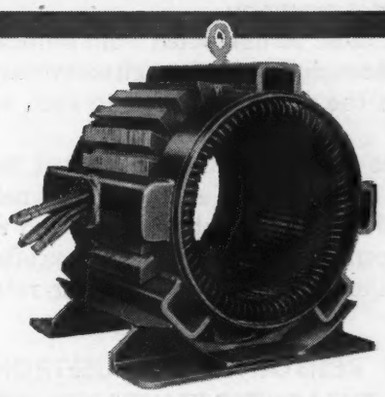
Although already accomplishing results which are classed as phenomenal, induction heating is just embarking on an avenue of development which appears to have no end. The rapid advances which are being made in scientific knowledge, and consequent improvement in the application of all phases of technology, and the extension of this knowledge to so many new products and procedures create a continual demand for the progressive changes which of necessity must occur. Careful analysis alone can determine the principles on which a new idea might be constructed and prudent application of these ideas to the fulfillment of a need of some specific purpose is essential. Induction heating is here to fulfill such needs.

Maintenance Costs Go Down and Costly Shutdowns Are Avoided When This Wagner Two-Frame Motor is Put on the Job





The Wagner type CP totally-enclosed fan-cooled motor has two frames: an outer frame that guides a strong cooling draft over the motor, and an inner frame completely sealed against the entrance of dust, fumes, or moisture into the vital parts of the motor.



The heart of the Wagner CP motor is this rugged, all-steel stator, rigidly constructed to meet the exacting needs of modern high-speed production. In larger sizes, the outer surface is deeply grooved (as here shown) to provide ample cooling surface for cool operation. The winding is completely taped well into the slots and all phase coils are insulated from each other by varnished-muslin phase-sheets.

The cost of maintaining open-type motors is likely to be excessive when dust, fumes, or moisture are present. Abrasive, conductive, or explosive dust, corrosive gases or fumes, steam and moisture are destructive to motors and cause frequent motor shutdowns for cleaning and repairing. The way to avoid excessive motor maintenance and production losses during motor shutdowns is to use Wagner type CP totally-enclosed fan-cooled motors which are fully protected against such destructive agencies.

As the upper diagram shows, Wagner type CP motors are self-protected against the entrance of dust, fumes, and moisture, and therefore give uninterrupted service despite severe operating conditions. Experience has proved time after time that motor protection costs less than motor maintenance, that maintenance costs go down, production goes up, and motor worries end when you standardize on Wagner CP motors throughout your plant.

Wagner type CP motors are available in several electrical types, and are but one of a widely diversified line of Wagner motors, all fully described in Bulletin MU-185 free upon request addressed to Wagner Electric Corporation, 6413 Plymouth Avenue, St. Louis 14, Mo.

M46-3

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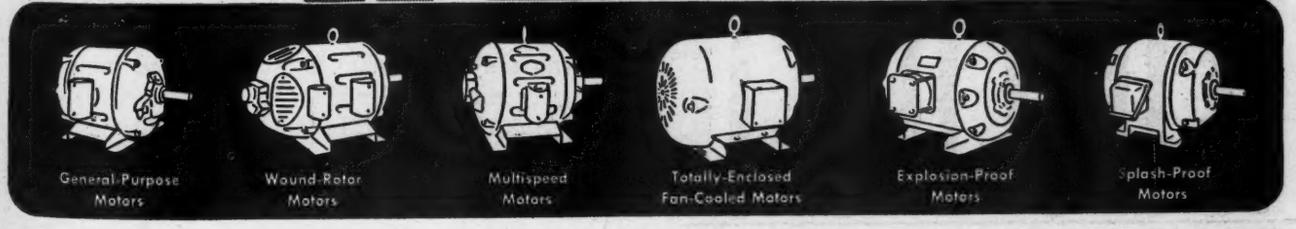

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You can:

Reduce Heating

in Panels and Switches

Keep circuits operating – Prevent costly shutdowns by installing FUSETRONS

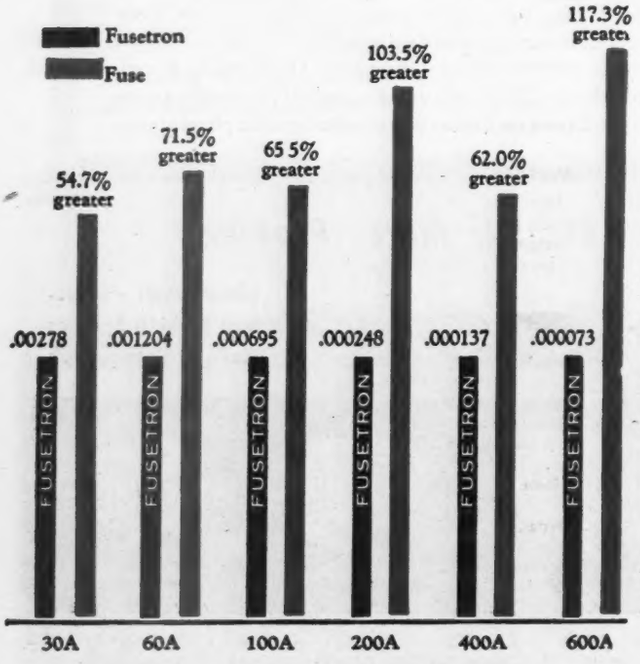
Fuses, like all other protective devices, operate from heat created by the current flowing through them. Thus they produce some heat even in normal operation.

This heat must be dissipated from switches and panels through the air, through metal parts and through the wires connected to such enclosures.

Sometimes the heat is not dissipated fast enough—so it piles up in switches or panels.

This piled up heat over-heats fuses and reduces their carrying capacity. Then fuses often blow even though not loaded to their rated capacity.

LOOK AT THE RESISTANCE OF FUSETRONS COMPARED TO THE LOWEST RESISTANCE FUSE



Resistance shown at full load in ohms. Chart shows 250 volt sizes. 600 volt sizes show similar results.

To solve the heating problem by putting in larger metal parts or wires to conduct heat away faster is always costly. A more logical answer is to cut down heat at its source by using Fusetrons—they produce less heat because they have less electrical resistance than ordinary fuses.

Cooler Operation of Switches and Panels Reduces Needless Blowing of Fuses

Install Fusetrons in your switches and panels and they will operate much cooler than with fuses because the heat produced by the flow of current is proportional to resistance and Fusetrons have very much less resistance than ordinary fuses.

This cooler operation means the elimination of needless blows and useless shutdowns that are the result of heating in fuses.

Cooler operation also adds to the life of panels and switches.

Here's PROOF Fusetrons Reduce Heating

Says an executive of a large Detroit Company. (Name on request.) "One-time fuses formerly used in a lighting circuit feeder panel got so hot that every fuse burned itself up and had to be replaced every month. Our Chief Electrician changed the fuses to Fusetrons of the same size. After three months, only one circuit had opened and the panel was very much cooler than it had been with one-time fuses. Subsequently we changed all our fuses to Fusetrons."

BUSS

Fusetrons do everything fuses do. They open on harmful overloads and on short-circuits stop the flow of current quickly and safely, all of which is confirmed by the Underwriters' Laboratories Label . . . and in addition you can

Get many kinds of protection, *heretofore* not available – *by installing* FUSETRONS throughout the entire electrical system

★ ***Entirely wipe out needless blows caused by motor starting currents or other harmless overloads.***

Fusetrons have tremendous time-lag. They hold 500% load more than 10 seconds whereas most sizes of ordinary fuses blow in less than one second. They won't open on starting currents or harmless overloads (heavy overloads for a short time or light overloads for a longer time). Fusetrons won't shut down a circuit needlessly. They open only when something goes wrong.

★ ***Give Thermal Protection to Panelboards and Switches***

The thermal cutout in the Fusetron will open whenever its temperature reaches 280° F. Thus if poor contact heat develops from any cause the Fusetron cuts off the current before damaging temperatures can be reached.

Ordinary fuses can't so protect because the temperature of the link must reach 786° F. before it will melt out.

With Fusetrons you are warned that a minor maintenance job is needed instead of having panel or switch damaged or destroyed by poor contact.

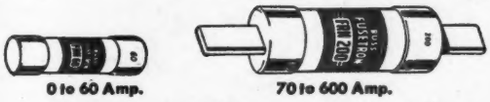
★ ***Prevent Needless Blows caused by Heating in Panels and Switches***

(*See Opposite Page*).

★ ***Permit use of larger motor or adding more motors on circuit WITHOUT installing larger switch or panel***

The operating load on Fusetrons can be close to their ampere rating because Fusetrons hold starting currents. But ordinary fuses must be installed oversize because they lack sufficient time-lag to hold starting currents.

WHAT IS THE FUSETRON?



0 to 60 Amp. 70 to 600 Amp.

The Fusetron is a DUAL element device—A Fuse to which is added a Thermal Cutout.

The result is a fuse with tremendous time-lag and much less electrical resistance.

Fusetrons have the same degree of Underwriters' Laboratories' approval for both motor-running and circuit-protection as the most expensive devices made.

Fit standard fuse blocks

Fusetrons are made to same dimensions as ordinary fuses and fit all standard fuse holders.

They are obtainable in all sizes from 1/10 to 600 ampere—in both 250 and 600 volt types.

Also obtainable in plug type and Tamper-resisting type (Fustats) for 125 volt circuits.

Their Cost is Surprisingly Low

By replacing oversize fuses with Fusetrons, you can load panels or switches near their capacity. A larger motor or additional motors can be installed without the trouble or expense of changing the panel or switch.

★ ***On new installations, PROPER size switches and panels can be used instead of OVERSIZE***

With ordinary fuses, switches and panels must be oversize because fuses larger than the operating load must be used to hold starting currents.

But Fusetrons hold starting currents, therefore, PROPER size switches and panels to fit the load can be installed, saving money and space.

★ ***Protect motors against burnout***

On normal installations, Fusetrons used in a size near ampere rating of motor will protect it against burnout from lack of oil, worn bearings, tight belt or anything that causes a dangerous electrical overload—yet their tremendous time-lag keeps them from blowing on motor-starting current.

★ ***Give DOUBLE burnout protection to large motors.***

Larger motors already equipped with overload protection sometimes burn out due to thermals or relays failing to operate. Replace fuses used for short-circuit protection with Fusetrons of size near motor rating and they will protect motor against burnout from any electrical overload, entirely independent of other overload device.

★ ***Provide simplest way to stop burnouts from single phasing***

When single phasing occurs, increased current flowing through remaining phase will open Fusetrons (if size used is near the rating of the motor) and shut down motor. Never before has such dependable single phasing protection been available.

★ ***Make burnout protection of SMALL motors simple and inexpensive***

Small motors have generally been operated without burnout protection because the cost of protecting them has been too great compared to cost of replacing motor. Now for the little cost of installing a Fusetron of proper size, any motor can be given safe, dependable burnout protection.

★ ***Protect Coils, Transformers and Solenoids against burnout***

Install a proper size Fusetron. It won't open on harmless overloads of normal current surges, yet should a dangerous overload occur for any reason it will cut off the current to prevent a burnout.

ACT ON THE FACTS; Even one needless shutdown or one lost motor or one destroyed panel may cost you more than replacing every fuse with a Fusetron. Don't risk such losses, change over the whole plant to Fusetrons at once.

FUSETRONS

GET THE FACTS — *CHECK THE COST*

146

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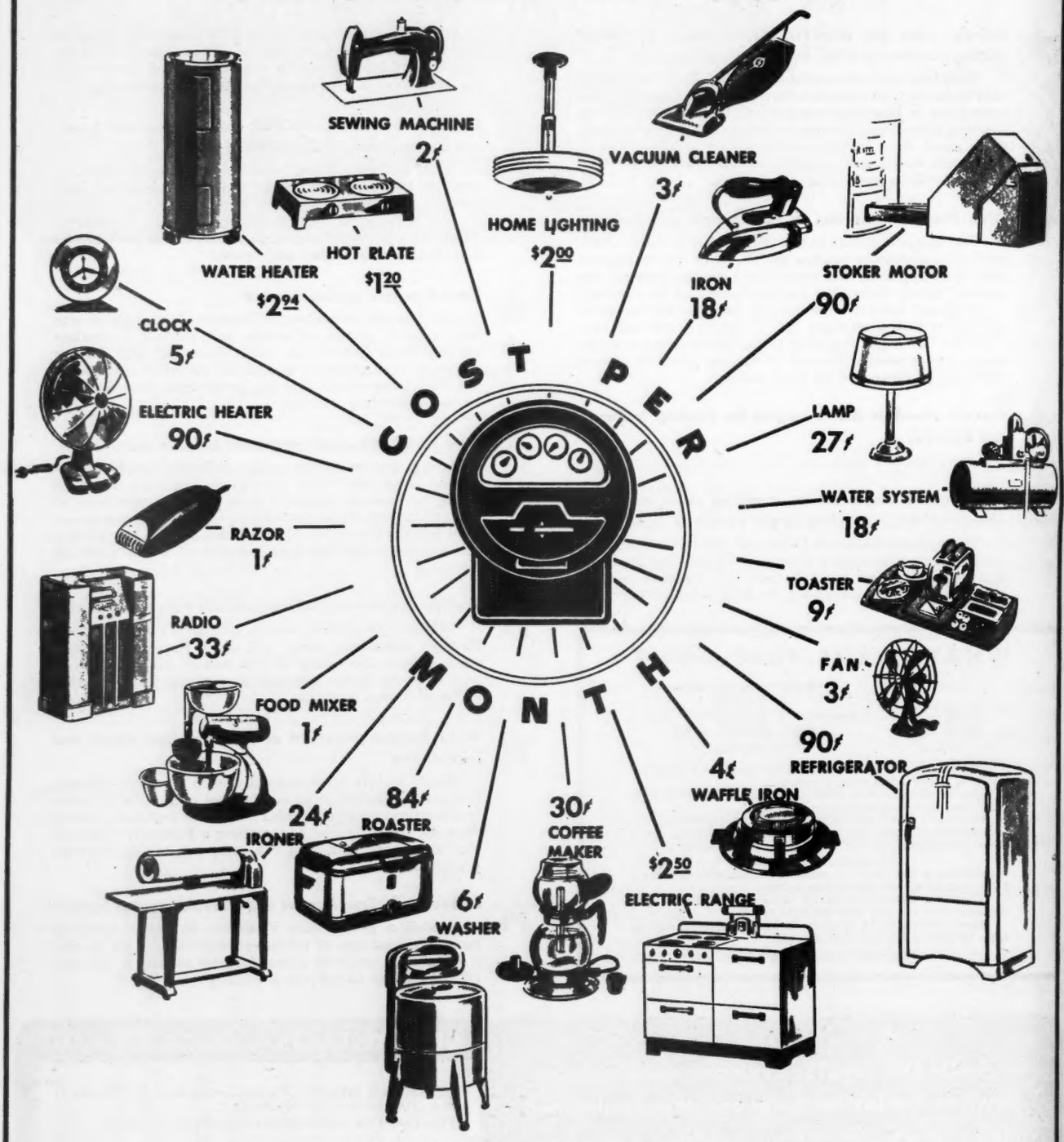
EC246

DATA SHEET

The number at the right is a classification for convenience in filing and for a future data sheet index

A-1

Cost of Operating Domestic Electric Appliances



AVERAGE ADDED COST OF OPERATING DOMESTIC ELECTRIC APPLIANCES

Residential Electric Appliances

Avg. Kwh. per month Consumed	Home Lighting	Vacuum Cleaner	Iron	Stoker Motor	Lamp	Water System	Toaster	Fan	Refrigerator	Waffle Iron	Electric Range	Coffee Maker	Washer	Roaster	Ironer	Food Mixer	Radio	Razor	Electric Heater	Clock	Water Heater	Hot Plate	Sewing Machine
Less than 50	2.00	0.06	0.34	1.42	0.50	0.34	0.17	0.06	1.42	0.07	3.42	0.56	0.11	1.36	0.45	0.02	0.62	0.01	1.42	0.08	2.94	1.72	0.04
50–120	2.00	0.03	0.18	0.90	0.27	0.18	0.09	0.03	0.90	0.04	2.50	0.30	0.06	0.84	0.24	0.01	0.33	0.01	0.90	0.05	2.94	1.20	0.02
Over 120	2.00	0.02	0.12	0.60	0.18	0.12	0.06	0.02	0.60	0.03	2.00	0.20	0.04	0.56	0.16	0.01	0.22	0.01	0.60	0.03	2.94	0.80	0.02

Data from the Wisconsin Power & Light Company, Madison, Wisconsin

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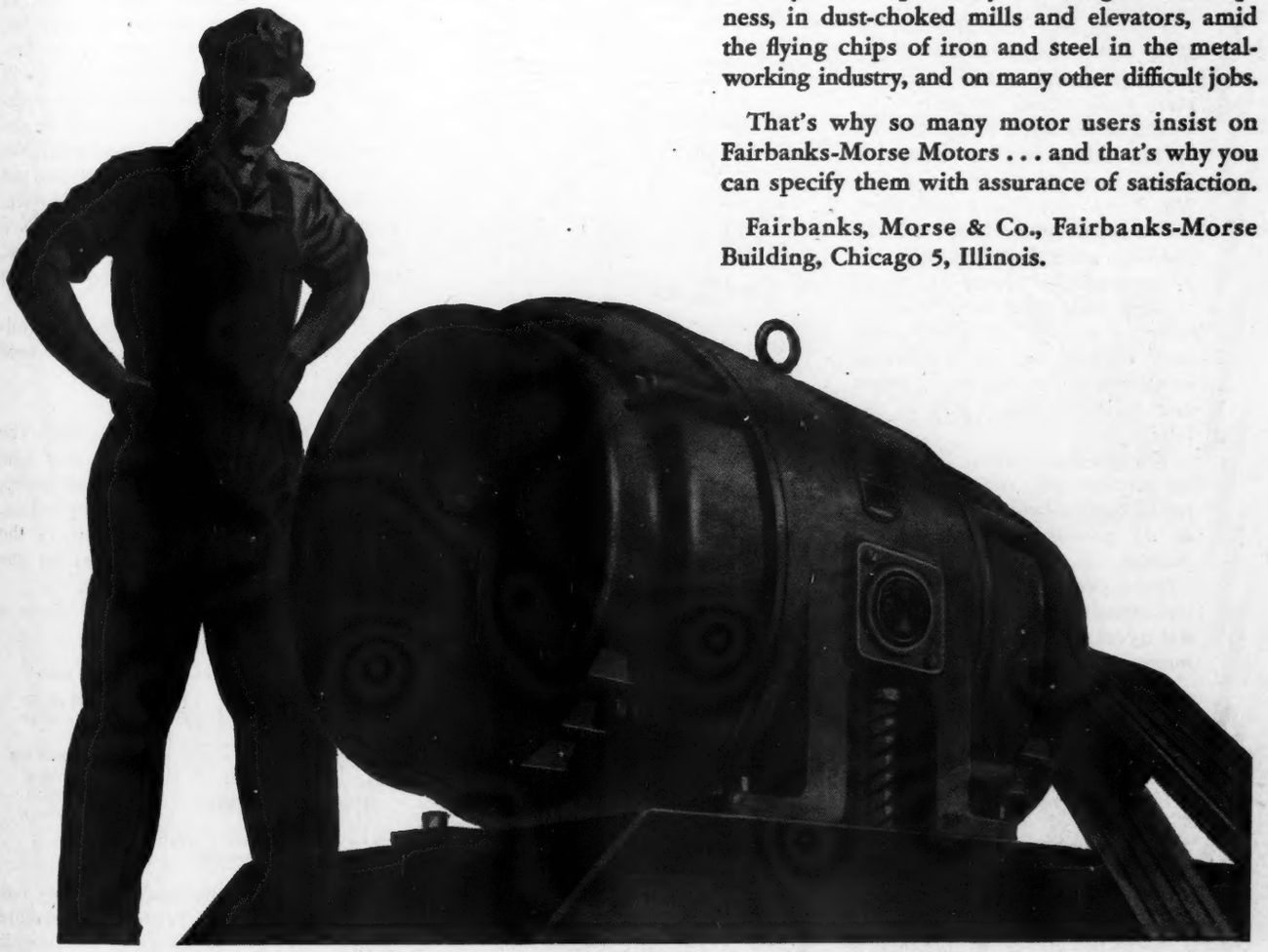
Fairbanks, Morse & Co., Fairbanks-Morse Building, Chicago 5, Illinois.



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READER'S QUIZ

CONTROLLING THREE PUMPS

QUESTION 206—We have three water pumps, each one has its own contactor, one of which is to run at a time.

The starting and stopping of these pumps is controlled by one pressure switch. The motor is three phase. Coils 220 volts.

Should the No. 1 pump kick out its overload relay, we want the No. 2 pump to start, and should No. 2 trip, then No. 3 is to start.

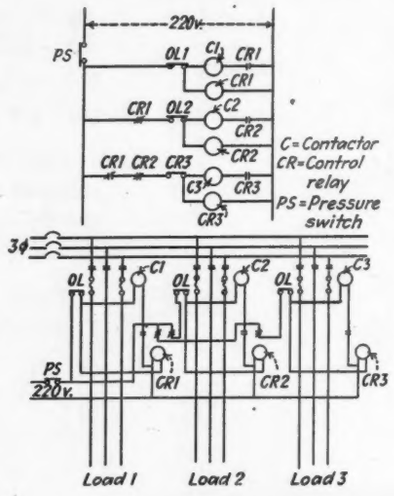
Whichever pump happens to be running must be stopped if the pressure switch opens.

At no time must more than one pump be running. If No. 2 pump were running and No. 1 overload relay reset, then the No. 2 pump is to stop and No. 1 pick up the load.

The pressure switch is controlled mechanically and has no electrical connection except to close at 45 pounds and open at 80 pounds.

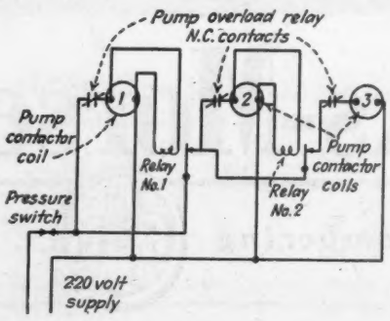
Flood switches in the tanks control signals only and at present do not affect the pump contactors or motors.—C.A.S.

A. TO QUESTION 206—The diagram shows a circuit which will meet the requirements of the question. For best operation, relay CR1 should operate and release at normal speed. Relay CR2 should operate with a slight delay and release at normal speed. Relay CR3 should operate with a slightly greater delay than CR2 and release at normal speed. This is to prevent a momentary closure of any two magnetic switches at one time. There is a very good pneumatic timing relay available which is ideal for CR2 and CR3. It can be adjusted for a time delay over a wide range. The control wiring of the magnetic switches will have to be changed a bit. Whenever the overload relay of number 1 switch is closed and upon the closure of the pressure switch, number 1 will be the only one to operate, CR1



having closed the control circuit to number 1 and opened the control circuits to number 2 and number 3 before their time delay would allow them to operate. If number 1 overload relay opens, CR1 will release, open number 1 circuit and close number 2 and 3 circuits. CR2 will operate first because of the greater time delay of CR3, will close the control circuit to number 2 and open the circuit to number 3 before it has had time to operate. If number 2 overload relay opens, CR2 will release, open number 2 circuit and close number 3 circuit. If at any time during this sequence, number one overload relay is reset, number 1 will operate and take 2 or 3 off the line. All motors are under control of the pressure switch.—S.S.P.

A. TO QUESTION 206—A solution would be to connect two 220 volt relays to the No. 1 and 2 con-



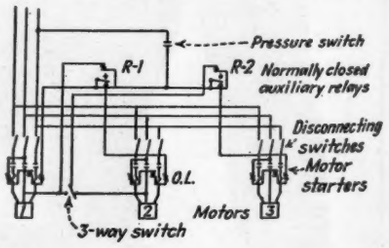
tactor coils as shown in the diagram. The normally closed contacts of the relays would control the contactors so that the pumps would operate in the desired sequence.

When the pressure switch closes all relays and contactors would start to operate. However, as soon as relay No. 1 opens, it removes all power from contactors No. 2 and 3. Pump No. 1 will then run until its overload relay operates. Then as relay No. 1 will be deenergized, contactor No. 2 and relay No. 2 will operate. Pump No. 3 cannot run as long as relay No. 2 is open. If overload of pump No. 2 takes place, No. 3 will then take over, and if any overload relay is reset, then that pump will take precedence.

If normally closed contacts are available on the contactors, they may be used in place of the relays.—J.F.Y.

A. TO QUESTION 206—The usual installation of this kind has a pressure switch for each pump, each with a different minimum setting. Then, if one motor should fail, or the draft on the tanks be too great for one pump, the next motor will start.

The accompanying diagram shows a



method of normally operating only one pump at a time. When the pressure switch closes, it connects to the line all three holding coils and the coils of two relays. When the starter of No. 1 motor closes, relay R-1 is fully energized, and disconnects the holding coil of No. 2 motor. Similarly, No. 3 motor cannot run if motor No. 2 or motor No. 1 is running.

The three-way switch is used when it is desired to take Unit No. 2 out of service.

A Safety Warning: Regard all motor

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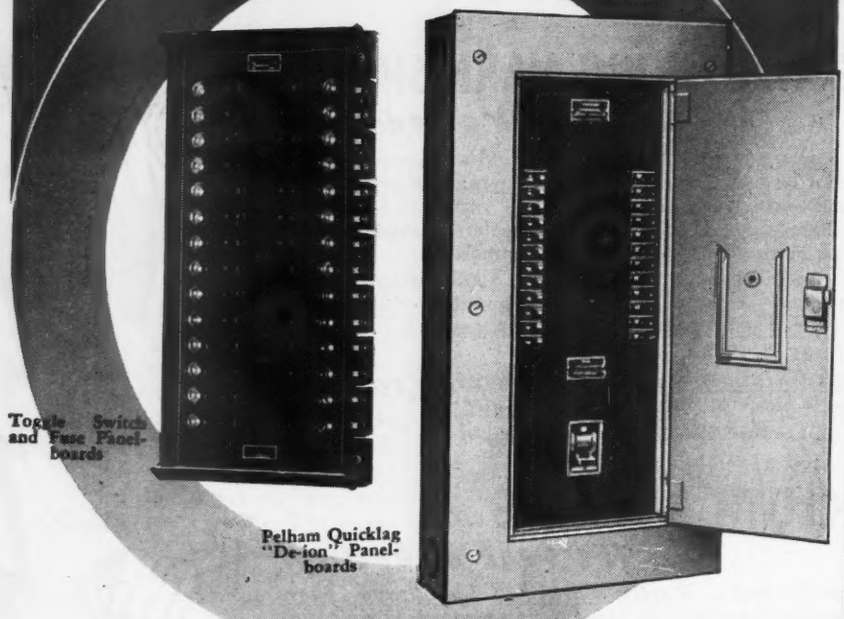

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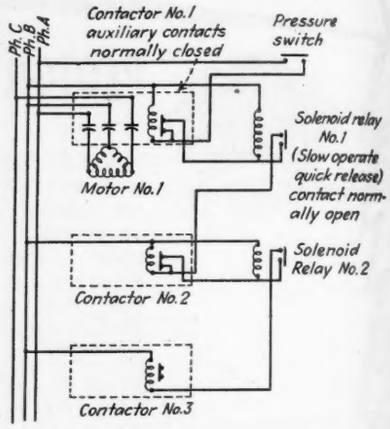
starters as being alive, even if their disconnecting switches have been opened. —L.E.B.

A. TO QUESTION 206—The pressure switch closes the circuit to the contactor solenoid and the solenoid relay, and since the contactor operates and opens its auxiliary contacts before the solenoid relay can operate to close its contacts, only motor No. 1 will start. If contactor No. 1 fails to operate, then

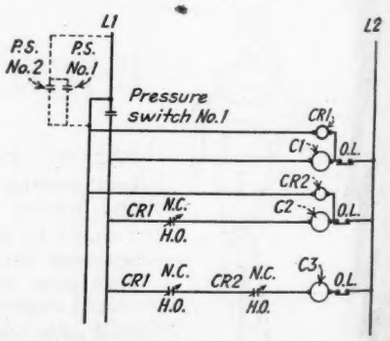


solenoid relay 1 will operate and close its contacts to contactor No. 2, in which case a similar sequence takes place.

If contactor 2 or 3 is operated and a preceding contactor picks up, then the succeeding contactor is instantly disconnected.—R.E.B.

A. TO QUESTION 206—The most foolproof and simple method by which your problem can be handled is a circuit using three ordinary magnetic contactors and control relays, one having two normally closed contacts, and one having one normally closed contact.

Connect as shown in sketch.



Pressure switch closes, CR1 and CR2 are already energized. (Either by direct connection or through a higher rated limit switch as shown by dotted lines.) CR1 and CR2 are holding open circuits C2 and C3 respectively. C1 closes. Should C1 overload trip CR1 is deenergized closing its two CR1 contacts energizing C2. C2 then runs its motor. Should C1 overload be reset, CR1 opens C2 and C1 becomes ener-

gized. C1 then runs its motor. Should C1 overload and C2 overload both be tripped, CR1 and CR2 are both deenergized closing CR1 and CR2 contacts energizing C3 which then runs its motor until either C1 or C2 resets are closed, which then takes over.

Pressure switch No. 2 (dotted lines) should, if used, kick on at 50 pounds and off at 60 or 55. Pressure switch No. 1 should then have double contacts as shown.—T.S.

ADJUSTING A HOT WATER SYSTEM

QUESTION 207—How can I adjust a hot water system, so that the hot water will flow through the radiators only when the thermostat starts the circulating pump? —H.S.

A. TO QUESTION 207—The problem would be solved by the installation of a flow control valve. If one is in place, it should be checked for free operation. A flow control valve is a check valve, normally closed by gravity, but opened by water force when the circulating pump starts.

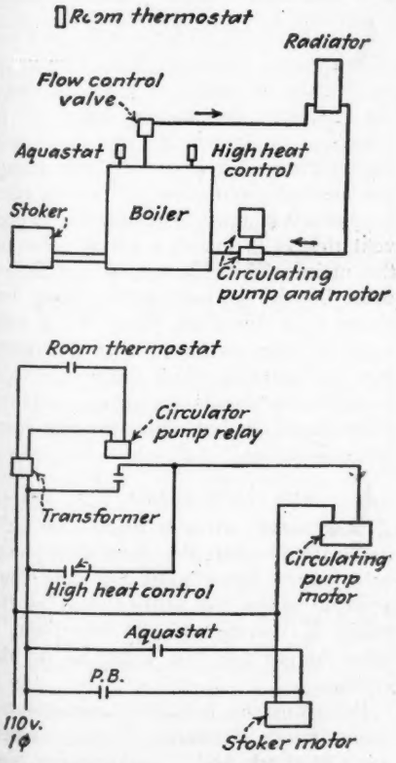


Fig. 1 shows a physical layout of a hot water house heating system, using forced circulation. The circulating pump should be near the boiler in the water return line. The flow control valve

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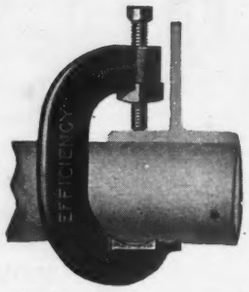
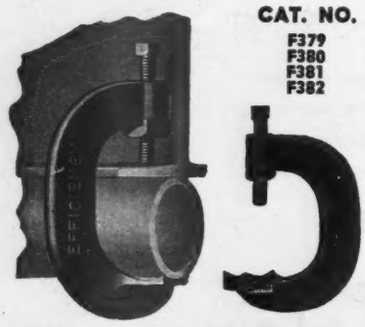
FOR
INDUSTRIAL CONSTRUCTION



• The most practical and widely adaptable hanger ever devised for supporting conduit or armored cable on open steel construction. Will carry pipe at any angle to beam.

CAT. NO.
F379
F380
F381
F382



Highest grade malleable iron, guaranteed against breakage. Set screw, cup pointed, tightened by free nut, plus 5-point radiating ridges of gripping surface holds pipe on true mechanical principle, guaranteeing a solid, non-slip support.

FOR PIPE AND CABLE SIZES
For armored cable
For ½" and ¾" conduit
For 1", 1¼" and 1½" conduit
For 2" and 2½" conduit

WRITE TODAY for our Catalog No. 38 . . . contains complete information on this and other EFFICIENCY Electrical Devices

Efficiency
ELECTRIC AND MANUFACTURING CO.

SpeedWay announces that an even better and more complete line of *SpeedWay* Electric Tools will soon be available to you at the same attractive pre-war *SpeedWay* prices. Already coming off the line, these are tools worth waiting for. Ask your dealer about them NOW!

SPEEDWAY MFG. CO.
1840 S. 52nd Ave.
Cicero 50, Ill.

should be located in the outgoing line from the boiler. The aquastat is a temperature controlled switch, so arranged that the stoker will start when the boiler temperature falls below a predetermined level. The stoker will be disconnected from the line when the boiler temperature rises to a predetermined point. The high heat control is merely another form of aquastat, arranged to start the circulating pump when the boiler temperature rises to an unsafe level. It is often omitted, but its use is recommended. It causes the boiler heat to be dissipated through the house.

Fig. 2 shows a complete electrical wiring diagram. Some manufacturers build the transformer into the circulating pump relay. The room thermostat contacts close when the room temperature falls, and open when the temperature rises. The better makes have less than a one degree overall tolerance. The momentary contact pushbutton is a scheme of the writer's. He found that he often wished to see how the fire was going after he removed the clinkers. With the pushbutton, he was able to test the stoker and fire even with the aquastat opened due to ample boiler temperature.

Variations of these devices are made by several manufacturers of heating and ventilating equipment. Ordinarily the devices are stocked by all plumbing supply houses. Installation directions are generally simple and complete.—L.E.B.

A. TO QUESTION 207—In a hot water heating system with gravity circulation, water is forced through the radiators due to the difference in densities of water at high and low temperatures. In a system with pump, the thermal circulation still exists after the pump is stopped. The best way to prevent this is to install a check valve on the main. This check valve is forced open by the action of the pump but closes tight when the pump is not running and thus overheating of the radiators is prevented. Such check valves are available in plumbing supply establishments handling hot water heating specialties.—A.W.C.

A. TO QUESTION 207—Ordinarily when a thermostat calls for heat and starts the circulating pump, cold water flows until the low limit aquastat starts the burner, and as the water is flowing during this time, it takes longer for hot water to fill the system.

By using the low limit aquastat for maintaining minimum water temperature desired, and a combination high limit and circulating pump control; connect the thermostat in parallel with the aquastat starts the burner, and as the for heat, then the high limit will stop the burner at the desired temperature and start the circulating pump, as the

boiler fills with cold water the high limit drops; stopping the pump and starting the burner again. This operation continues until the thermostat is satisfied, then the aquastat takes over. Using this method, only hot water is circulated. I have added a timer and an additional aquastat to my system, setting the night aquastat at 100° and the day aquastat at 140° (with thermostat at 70° in parallel) high limit 165°. During winter, I open flow control valve and feed by gravity, with thermostat and circulator as booster. This operation has been successful the past few years keeping the house comfortable while saving oil.—C.J.G.

A. TO QUESTION 207—Weighted check valves are installed in the outlet of the heating boiler operated by the pressure head of the circulating pump installed in the return line from the radiators.

These valves are given various names by the manufacturers, although the purpose of their installation is to control the flow of water by not allowing the hot water to circulate through the radiators until the thermostat "calls for heat".

The advantages of these installations are well substantiated in practice. Among them are (1) the almost instant transfer and ready availability of heat to the radiators when required; (2) through orifices there is an almost perfect control of the physical distribution of the heating medium; (3) reduced heat losses when the distribution system is idle; and (4) a year around source of hot water for domestic uses at a nominal cost.—E.F.W.

Can you ANSWER these QUESTIONS

QUESTION C9 —At our large slaughter house it is necessary to drive the cattle up a chute to the killing floor at the third story. It is customary in slaughter houses to use an electric prod pole, fed by a cord and ring sliding on a bare live wire which extends the length of the chute, to control the unwilling victims. The energy for this use is obtained from the 110 volt lighting circuit with one lamp in series.

Using 110 volt supply is the simplest and most fool-proof solution, but it does have bad effects on some cattle so that they don't bleed properly and occasionally it even kills one in the chute. Furthermore, there is the ever-present hazard of accidental contacting by humans. We have tried to use other sources of current with the objective of limiting the current capacity.

Fence controllers don't work very well. Spark coils work all right in driving cattle into trucks, but they don't seem to produce results at the killing floor. (There is some difference of opinion about whether or not a cow is sensitive to the smell of the blood.)

THE Superior REPLACEMENT...
Ask us about Superior Silver Impregnated Brushes
Superior Carbon Brushes
Superior Carbon Brushes are already standard equipment on more than 30 makes of electric motors. The experience thus suggested — "since 1919" — is your assurance that Superior brushes excel likewise for replacement purposes. A wide range of grades, including carbon, graphite, electrographitic, metal graphite. A wide range of uses, from heavy duty motor and generator service to fractional horsepower motors for household gadgets. Ask your nearest Superior distributor about Superior replacements.
SUPERIOR CARBON PRODUCTS, INC.
9113 George Ave. Cleveland 5, O.
"Since 1919"
SUPERIOR CARBON BRUSHES

E·M·T CONNECTIONS IN A FEW SECONDS!
With B. M. Fittings

TWO QUICK SQUEEZES give you Finer, Faster Conduit Connections. B-M Fittings do away with the twisting, turning and tightening of nuts and save you valuable time and materials. Then too, they are stronger, neater and much easier to work with in tight places. Start using B-M Fittings today. Have more satisfied customers—more profits from each job!

(All B-M Fittings carry the Underwriters Seal of Approval)

DISTRIBUTED BY
The M. B. Austin Co., Chicago, Ill.
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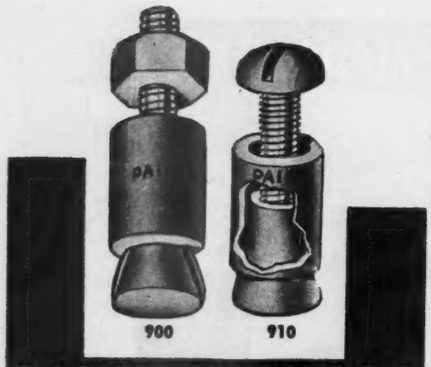
BRIEGEL METHOD TOOL CO. • Galva, Ill.



PAINE ANCHORS
Stay Put
IN MASONRY and CONCRETE

Lead Expansion Type Resists Shock Stress and Strain

For firm, permanent anchorage — in fragile or tough materials—use Paine Lead Expansion Anchors. They are extra strong—have stepped-up holding power—and will not rust. Easily and quickly installed, they provide sure support for hanging electrical fixtures or mooring small machines and motors.

Fig. 900 (Machine Screw Type) is available in 9 standard diams. from 6-32 to ⅝".

Fig. 910 (Bolt and Nut Type) is available in ¼", ⅜", and ½" diams. in standard lengths.

PAINE DRILL BITS
Dig Into
Masonry & Concrete

365

Paine Carboloy Tipped Drill Bits cut clean, round anchor holes with speed and accuracy. 50 to 75% faster than other drill bits, they bite into the toughest materials often without using a pilot hole. They are smooth and quiet in operation — prevent fractured surfaces — and eliminate flying chips. Can be used in any rotary drill (slow speed). Available in sizes 3/16 through 1¼" diams. (graduated in 1/16" sizes.)

Ask your Supplier or write for catalog.

THE PAINE COMPANY

2961 Carroll Ave., Chicago 12, Ill.

Offices in Principal Cities

PAINE
FASTENING and HANGING DEVICES

A 24 volt transformer works all right if the cattle are wet, but some meat inspectors won't permit cattle to be wet down.

Perhaps there is someone who has a simple solution to this problem or can tell me why the spark coil doesn't work at the killing floor. Our main objective, as I mentioned before, is to use a source with a definite limit in current capacity.—T.R.H.

QUESTION D9—A store in upstate New York has a 100 ft. frontage with sidewalk 12 feet wide which must be relaid this spring. We are exploring the possibility of installing soil heating cable to keep the walk free from ice and snow. I would like to know something of the experience of others with this kind of job. Is it practical? What size and length of cable should be used? How many kilowatts would it take?—S.W.

QUESTION E9 —I would like to know the success that readers have had in making a test panel for testing fluorescent lights from the smallest to the 100 watt size. We have a panel in the shop but it is quite bulky and I believe that it could be more compact and yet get a quick test on ballast, lamp, starter and compensator, if separate, and either a high or low-power factor ballast. I would like to see a diagram of such a tester.—C.S.S.

QUESTION F9 —I wish to rewind several single phase magnet coils for a lower voltage. As the flux in the magnetic circuit will remain approximately the same, is it necessary to increase the area of the shading coils?—T.B.

QUESTION G9 —We have a 10 kw motor generator set which persists in losing its residual magnetism. On many occasions I have noticed a "ground" on the a.-c. system and have assumed this to be the cause of the demagnetization. Am I correct?—B.T.

QUESTION H9 —Some Tyrill voltage regulators which we use to control the excitation on our alternators have after many years of faithful service, reached the point where they must be replaced.

The suggestion has been made to replace these regulators with tube control, possibly an adaptation of the Thymotrol circuit as used to control the speed of a d.-c. shunt wound motor.

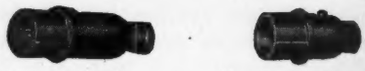
Each machine is rated at 750 kva., 2300 v., 60 cycle, and is direct driven from a 850 hp., 400 v., 25 cycle motor with 120 v. exciter mounted on the same shaft. d.-c. amperage varies from 20–23 amps. and the load is fairly constant.

Can any reader inform me if this is sound practice and how can it be accomplished?—A.R.

QUESTION J9 —What is the procedure in making polarity tests on current (instrument) transformers?—T.B

PLEASE SEND IN YOUR ANSWERS BY MARCH 1

GENERAL PURPOSE
Plugs and receptacles

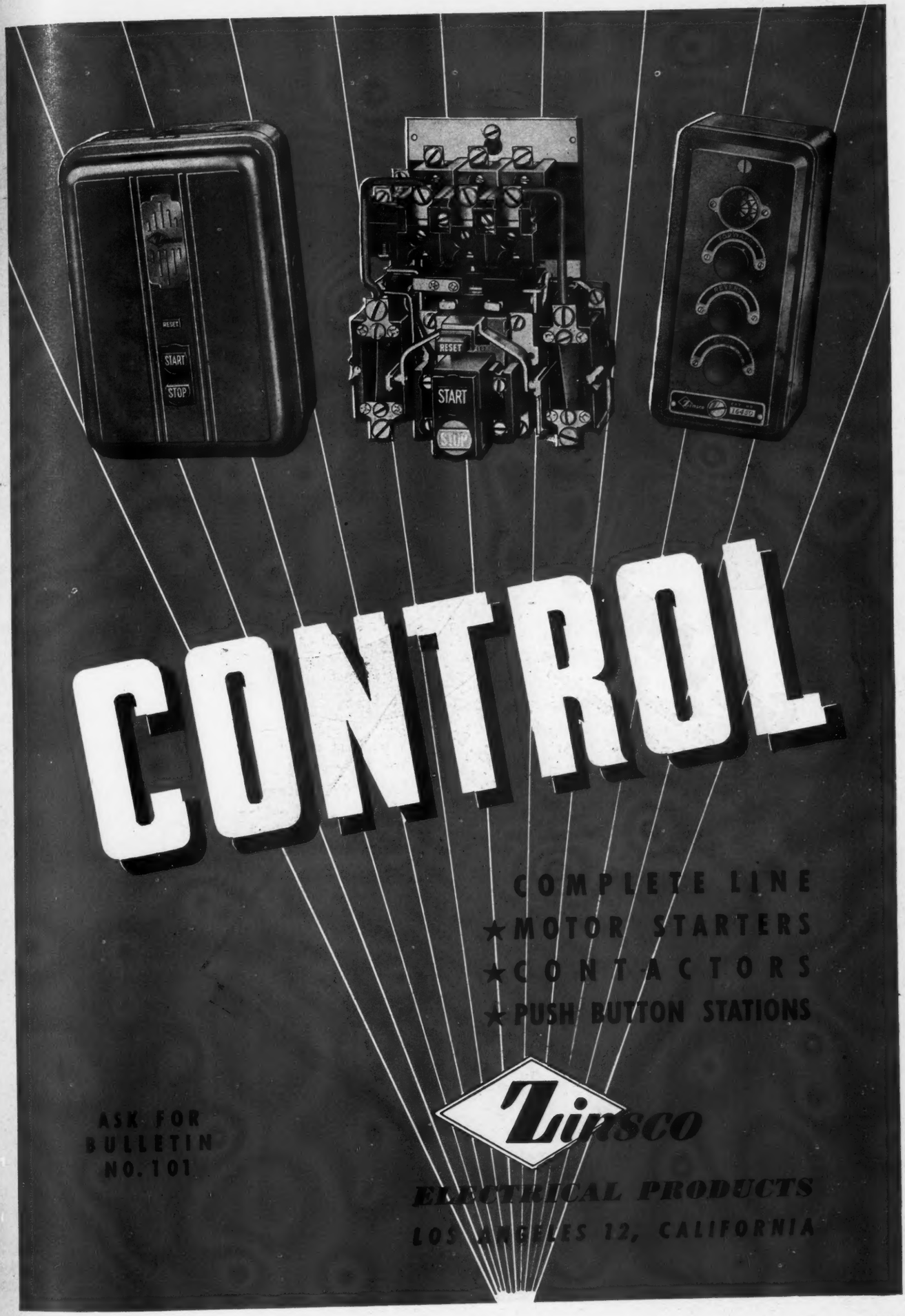


General purpose plugs and receptacles with round prong contacts are ideal for portable equipment wiring—available in 2, 3, 4, and 5 pole types, 30 amp. 125 volts DC, 250 volts AC.

Fuseless plugs and receptacles are also available in 60, 100 and 200 amp. ratings up to 600 volts, for disconnect service.

Consult your Pylet catalog for complete listings.

THE PYLE-NATIONAL COMPANY
1344 N. Kostner Avenue, Chicago 51, Illinois


RESET
START
STOP
RESET
START
STOP
CONTROL
COMPLETE LINE
★MOTOR STARTERS
★CONTACTORS
★PUSH BUTTON STATIONS
ASK FOR
BULLETIN
NO. 101
Linsco
ELECTRICAL PRODUCTS
LOS ANGELES 12, CALIFORNIA

GENERAL ELECTRIC
G-E LAMPS
1. Pay good, consistent profits.
2. Make more sales—everybody needs lamps.
3. Provide a year 'round, steady demand.
4. Require no investment in stock. Because G-E Lamps are furnished you on consignment, you pay for them only after you sell them.
5. Reduce stock loss to a minimum. G-E Lamps are a standard, non-perishable item. No loss through breakage or obsolescence.
6. Build good will because more people prefer G-E quality.
7. Provide a constantly expanding market through consistent advertising.

How many profit items can you name

. . . that offer all the advantages of G-E Lamps?

TAKE features like G-E's 1946 advertising campaign, biggest lamp promotion program ever undertaken by General Electric. It includes full-pages in 16 leading mass circulation magazines, 125 big trade publications, *plus* a nation-wide radio network show—The G-E Hour of Charm—pushing lamps and lighting week after week over 125 stations that reach into homes everywhere.

Take that total of 700,000,000 sales messages aimed at lamp buyers . . . and add to it a point-of-sale display program. A program that gives your dealers unique new G-E displays in brilliant full color, to help them sell more lamps *faster!*

The result? An unexcelled profit-item that gives you more and more sales advantages. That means G-E Lamps are easier-to-sell. It means too, you can start to call on dealers NOW. Urge them to take these 3 simple steps and make more sales:

1. Tie-in with G-E national advertising by featuring current G-E Lamps from the Post, Life, Time, etc.
2. Set up a mass display of G-E Lamps on the counter, in the window, or near the door.
3. Check their lamp stocks for popular sizes.

Shorter days mean longer burning hours at night—more reason to push G-E Lamps immediately. Every wired home uses lamps and needs replacements. Are your dealers getting this business?

G-E LAMPS

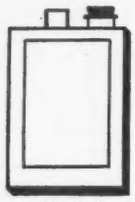
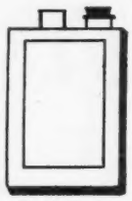
GENERAL ELECTRIC

the Lamps that Bring 'em In . . . and Bring 'em Back!

Dolph's #238 Black AIR DRYING VARNISH

CONVENTIONAL BLACK AIR DRY	DOLPH'S #238
Settling	Non-Settling

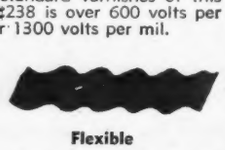
Unlike conventional varnishes of this type, the non-pigmented formulation of #238 prevents any "settling out" of color when stored for a period of time.

	
Special	Regular

#238 does not require a **special thinner.** For reduction purposes, use Mineral Spirits (Turpentine substitute), which is obtainable anywhere. The flash point of this solvent meets Underwriters' Approval.

Average	Exceptional

Both wet and dry dielectric strength of #238 far exceeds the limit afforded by most standard varnishes of this type. The wet dielectric of #238 is over 600 volts per mil. The dry dielectric is over 1300 volts per mil.

	
Brittle	Flexible

The flexibility life of #238 is well over 1000 hours. Most conventional types do not reach 300 hours in this test.

Oil resisting	Oilproof

Most standard grades require long drying periods before they are oil resistant. #238 is immediately oilproof.

Realizing the ever present need for an outstanding black, flexible oil-proof finishing varnish, the DOLPH Laboratories, backed by their long years of experience and research, have created, and now make available to you, a new black air drying varnish . . . #238. We definitely feel that this product with all its exceptional attributes, is timely and worthy of your attention.

In addition to the advantages already illustrated, #238 possesses the following characteristics, all included in its formulation to produce better results for you . . . a non-fading opacity which permits excellent hiding power and coverage . . . the slow initial set of this grade affords ultimate ease in application, whether brushing, dipping or spraying, and also provides uniform coverage . . . high degree of resistance to both fresh and salt water.

Although not a baking varnish and not intended for coil impregnation, #238 has many baking varnish properties.

To gain all these qualities of #238, it is only necessary to air-dry this material 6 hours, against 8 or more hours required by similar varnishes of this type.

MAY WE SUGGEST you send for a small sample on your Company letterhead, so that you may conclusively prove the merits of #238 Black Air Drying Varnish. This entails no obligation on your part.

Insulating Dolph's *Varnish Specialists*

JOHN C. DOLPH COMPANY

1060 BROAD STREET · NEWARK 2, N. J.

MOTOR SHOPS

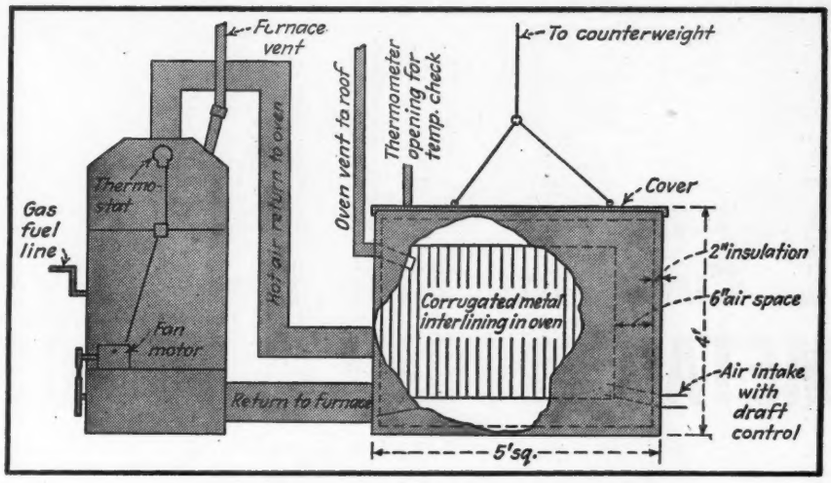
FULL AUTOMATIC OVEN CONTROL

The Vinson-Carter Electric Co., of Phoenix, Ariz., has designed and built an oven that is fully automatic in its operation and is giving complete satisfaction. The accompanying schematic drawing and photograph show the general principles of its design.

The oven, which is 5 ft. by 5 ft. by 4 ft. high, in outside dimensions, has an interlining of metal enclosing the oven proper. This interlining is separated from the outer wall by a 6-in. air space and 2 inches of insulation.

From the gas-fired furnace at the left, hot air is circulated by fan through the air space, heating the oven proper to a temperature up to 250 degrees F if desired. A thermostat, with control switch located at the switchboard, maintains the oven temperature at any desired setting. The thermostat equipment is also provided with a time switch controlled cut out, in case it is desired to leave the furnace unattended for a given length of time and then have it shut down automatically. For the purpose of checking temperature, in case the automatic control is discontinued for any reason, a thermometer opening is provided to the interior of the oven.

For safety reasons, fumes must be allowed to escape from the oven interior, which is accomplished by providing an oven vent to roof and an air intake with draft control.

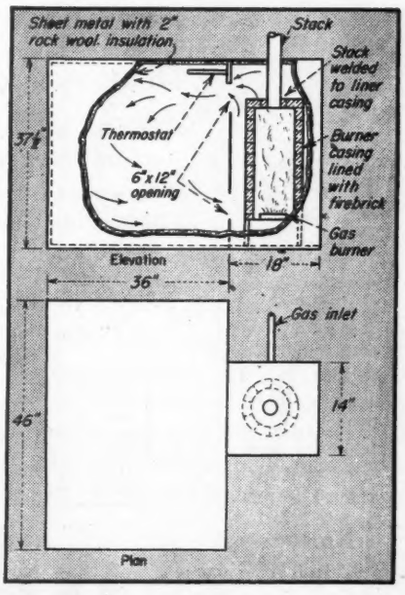


Schematic diagram of automatic oven control.

BAKING OVEN

W. J. Ridge, proprietor of the Valley Electric Motor Service, Fresno, Calif., built this circulating type of baking oven some years ago and has found it long-lasting, efficient and economical in operation. It is large enough to take a 75 hp. motor complete, if necessary for drying-out purposes. A maximum temperature of 450 degrees F. can be obtained, though for most work it is operated at 250 to 320 degrees. It is provided with thermostatic control, with pilot light.

Oven and circulating hot air furnace designed by Vinson-Carter Electric Co. The small gas oven on the metal stand is not part of the equipment.

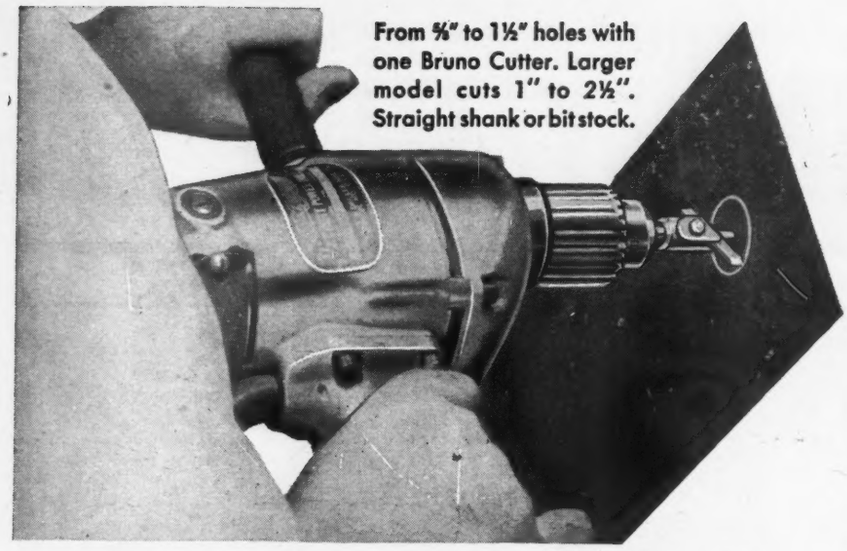


The plan and elevation of baking oven.

The fuel used in this baking oven is gas.

As shown by the plan and elevation, dimensions are 36 in. by 46 in. by 37½ in. for the main oven, which is built with angle iron frame and outer and inner shell of sheet metal, with two inches of rock wool insulation between, on all sides except the bottom.

The heater is enclosed in an adjoining compartment and consists of a cylindrical casing lined with fire brick. In the bottom of this cylinder is the circular gas burner, the fumes being con-



From ⅝" to 1½" holes with one Bruno Cutter. Larger model cuts 1" to 2½". Straight shank or bit stock.

Cuts Any Size Hole in METAL-WOOD-PLASTICS

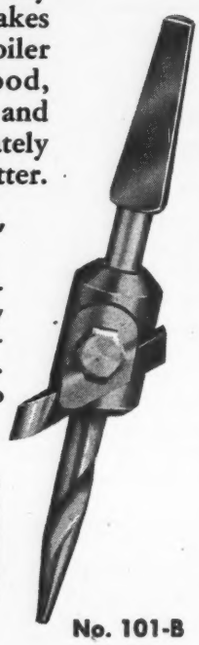
In the shop or on the job, replace many fixed-radius cutters with Bruno. Makes clean, fast holes in sheet metal, boiler plate, light metal alloys, plywood, plastics, masonite, rubber, fibre and other materials. Easily and accurately set for any diameter in range of cutter.

Works well in Portable Drill, Hand Brace or Drill Press.

New uses every day for Bruno Cutters. High speed steel blade easily resharpened. Rugged construction. Designed by tool engineers. Ask your jobber, or write Bruno Tools, Beverly Hills, Calif., Dept EC-2.

No. 100
⅝" to 1½"

Model No.	Shank Size	Cutter Expansion Capacity	User's Price
100	¼" straight shank	⅝"-1½"	$3.00
100-B	Square Bit Stock	⅝"-1½"	$3.00
101	⅜" straight shank	1"-2½"	$5.00
101-B	Square Bit Stock	1"-2½"	$5.00

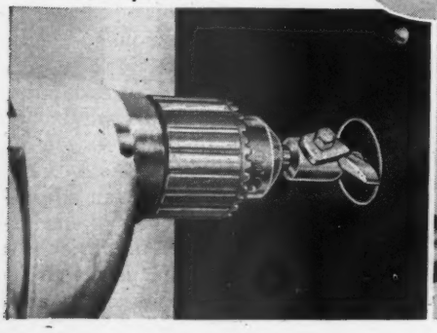


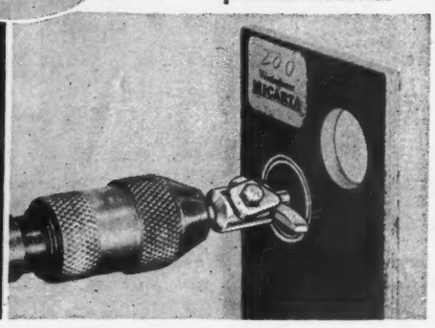
No. 101-B
1"to 2½"

BRUNO TOOLS

Ideal for electric drills and light drill presses.

Cuts deep holes in wood or compressed material



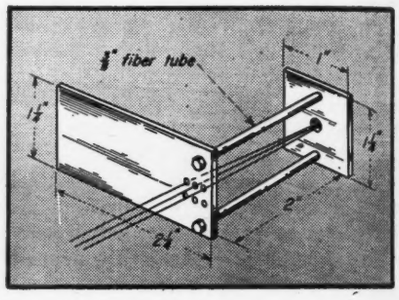


ducted away by a stack. The burner itself is also enclosed in the shell.

As the bricks and metal shell are heated, the air inside the heater compartment passes out into the oven chamber through a 6 in. by 12 in. opening near the top, and returns by means of a similar opening near the bottom, a constant circulation maintained without the use of a fan.

MULTIPLE WIRE HOLDER

When laying two or more wires on, in coil winding, it is not easy to hold the wires in the hands or keep them in order over a straight edge so that the wires will not cross. Freeman Orne of The Motor Shop, Los Angeles, made this



Simple construction suggests duplication of this fibre board wire holder.

gadget, which works satisfactorily. Some fiber board, two pieces of fiber tubing and two bolts and nuts were cut and assembled to the dimensions shown on the sketch. According to Orne, all you have to do is to run the wires through the holes, as shown, and "aim" it in the right direction and the wires will then lay down side by side in the order determined.

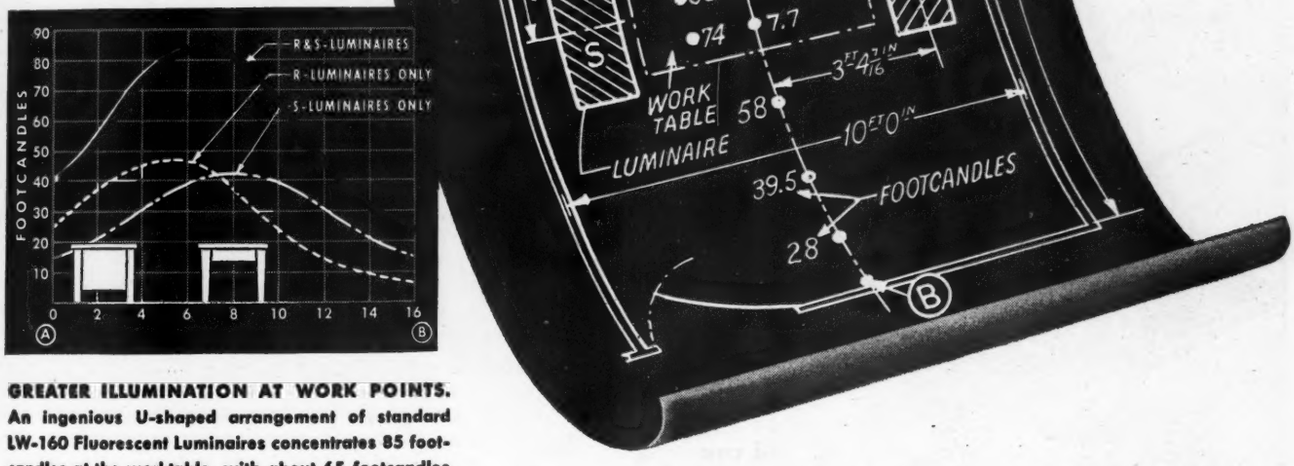
REBUILT MOTORS TO CARRY LABEL

Electric motors and generators rebuilt in the shops of NISA members throughout the country will carry a label attesting to the fact that the equipment has been rebuilt according to the NISA Rebuilding Standards—a copyrighted set of working standards approved by the National Industrial Service Association in April 1945. These specifications and standards (E. C., Nov. 1944, pg. 40—standards submitted for national adoption) are minimum requirements, covering 25 specific points, developed to form a guide and a consistent method for rebuilding electric motors and generators sold by members of the Association.

The decal label (see illustration),

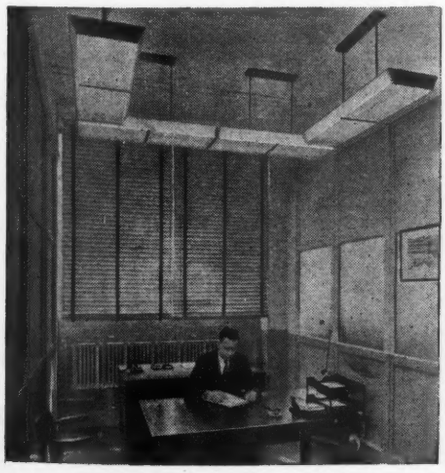
A NEW LIGHTING APPLICATION TECHNIQUE

OPENS UP NEW MARKETS FOR ELECTRICAL CONTRACTORS



GREATER ILLUMINATION AT WORK POINTS. An ingenious U-shaped arrangement of standard LW-160 Fluorescent Luminaires concentrates 85 footcandles at the worktable, with about 65 footcandles on the desk. Greater seeing comfort is further provided by a low brightness contrast over the surrounding area. After 1000 hours of burning, the average illumination from A to B was 57 footcandles.

BELOW: Westinghouse LW-160 Fluorescent Luminaires provide a shielded light source and soft diffused illumination. U-shaped arrangement directs reflected glare away from the eyes of the person at the desk.



With the introduction of a new fluorescent lighting technique for private offices, Westinghouse opens up new markets—and additional profit opportunities—for electrical contractors. As simple to install as it is sound, this new approach to private office lighting concentrates an abundance of illumination where it is most needed—on the work table and desk. It further aids seeing comfort by providing a gradually diminishing brightness contrast over the surrounding area. The U-shaped arrangement directs reflected glare *away* from the eyes of the person at the desk.

This new technique is flexible, for in addition to the U-shaped arrangement illustrated, functional lighting like this may be achieved simply by varying the arrangement of the luminaires. Be sure to get your copy of Bulletin B-3662 which describes this new technique. For this and application engineering assistance, contact the nearest Westinghouse Distributor. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa. J-04068-A

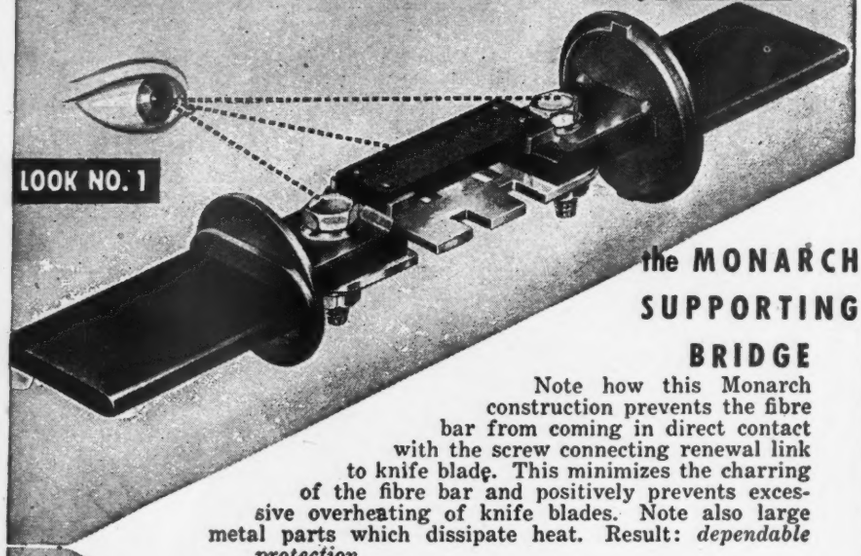
Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

Lighting Equipment

AVAILABLE THROUGH 127 WESTINGHOUSE ELECTRIC SUPPLY CO. OFFICES AND INDEPENDENT DISTRIBUTORS

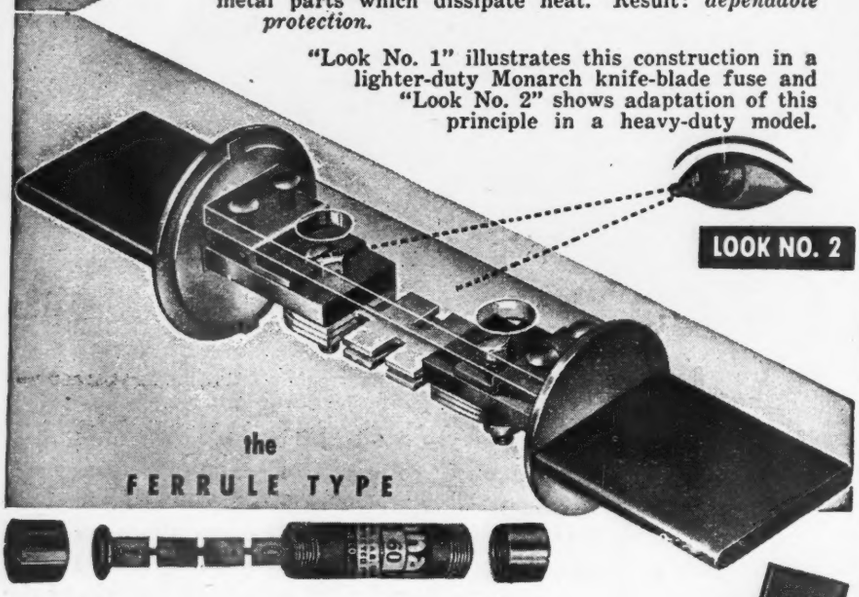
Take a TWO-WAY LOOK AT THE Monarch Fuse



the MONARCH SUPPORTING BRIDGE

Note how this Monarch construction prevents the fibre bar from coming in direct contact with the screw connecting renewal link to knife blade. This minimizes the charring of the fibre bar and positively prevents excessive overheating of knife blades. Note also large metal parts which dissipate heat. Result: *dependable protection.*

"Look No. 1" illustrates this construction in a lighter-duty Monarch knife-blade fuse and "Look No. 2" shows adaptation of this principle in a heavy-duty model.



the FERRULE TYPE

Specify Monarch Fuses *for improved* FUSErvice

Monarch RENEWABLE Fuses

MONARCH FUSE CO., LTD.

118 E. FIRST ST., JAMESTOWN, N. Y.

which participating members are authorized to place on motors and generators built according to the standards, has been designed with an attractive red and yellow background and will be registered with the U. S. Patent Office as a trademark. Members can have the name of their company imprinted on the blank space at the bottom of the trademark.

NISA members desiring to use the label are required to sign a Certificate of Participation signifying that they will subscribe to and adhere to the NISA Rebuilding Standards currently in effect. (The Standards are subject to amendments from time to time as conditions

NISA Label that will appear on motors and generators reconditioned in accordance with NISA Rebuilding Standards. Name of service shop is imprinted in blank space of label.

and practices change. Such amendments are subject to the discretion of the Rebuilding Standards Committee then in office and to the approval of the NISA Board of Directors). In addition to affixing the label to the equipment, the participating member agrees to state on his invoice to the customer the fact that the equipment sold is reconditioned according to these Standards.

NISA headquarters recently announced that booklets containing the officially adopted Rebuilding Standards are now available to members for distribution to their customers. The decal labels are also available to participating members for use on their equipment.

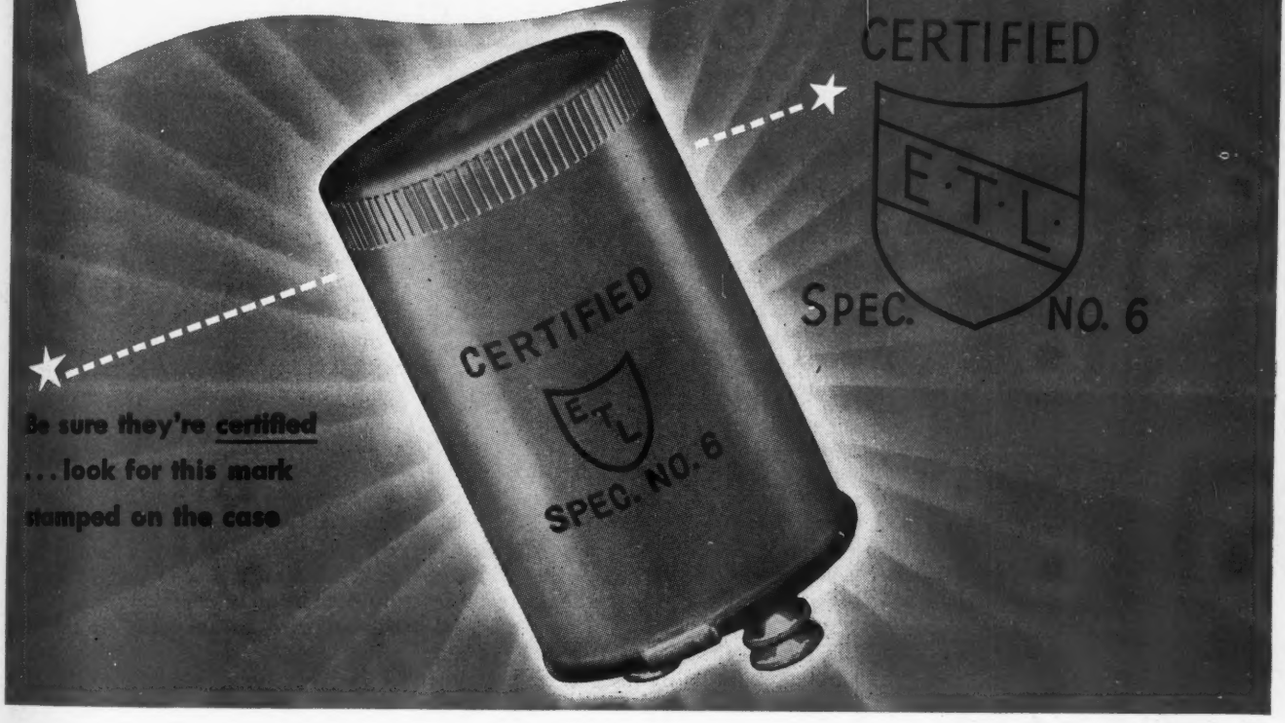
The trademark label is intended for use only on equipment that has been checked and found to meet all the minimum requirements of the Standards.

CLEANING VACUUM CLEANER BAGS

The time and annoyance, not to mention respiratory hazards, entailed in

Why CERTIFIED STARTERS

mean less replacement . . . better lamp performance



Here's the answer in a nutshell: Certified Starters are built to do the job right!

1. **Certified Starters** are made to the requirements of leading fluorescent tube makers for good lamp performance and dependable service. And they're built to definite standards of quality.
2. **They're checked by E.T.L.** . . . under actual operating conditions and forced operating conditions to make sure that they meet the specifications before Certification is granted. And they're subject to both regular and special re-checks.

When you buy new fluorescent lighting fixtures and when replacement starters are needed . . . *be sure to get CERTIFIED Starters* . . . for longer lamp life, better lamp performance and more satisfactory lighting service.

Certified Starters are specified equipment of Fleur-O-Lier and RLM fluorescent lighting fixtures.

The Manufacturers of

Certified Starters

The Arrow-Hart and Hegeman Co., Hartford, Connecticut
The Bryant Electric Co., Bridgeport, Connecticut
Dura Electric Lamp Co., Newark, N. J.
General Electric Co., Bridgeport, Connecticut
Harvey Hubbell, Inc., Bridgeport, Connecticut
Instant Glow Starter Corporation, New York, N. Y.
Kuthe Laboratories, Inc., Newark 4, N. J.
The Lloyd Products Co., Providence, R. I.
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You get
ALL THREE with a
BLACKHAWK
PIPE BENDER

Blackhawk Benders do MORE than bend pipe. They include a Porto-Power Hydraulic Unit that performs this triple job:

1 PIPE BENDING
Bends rigid conduit and pipe of all popular diameters. Saves need for elbows, couplings and extra cutting and threading.

2 MAINTENANCE and PRODUCTION
Porto-Power pushes, pulls, bends, presses, spreads, and clamps—pulls gears, lifts machinery and licks scores of other jobs.

3 SPECIAL JACK
Compact Hydraulic Ram works in all directions — at any angle. A versatile, safe, remotely controlled jack.

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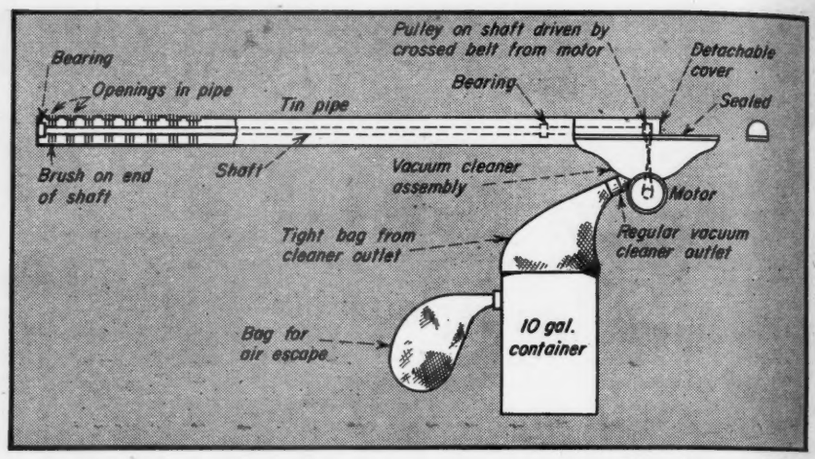


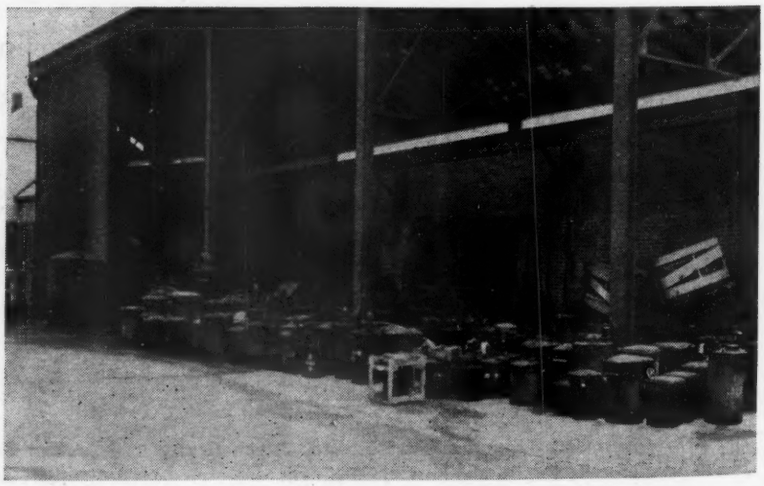
Details of vacuum bag cleaner indicate location of revolving bristles in muzzle of cleaning gun. Dirt is brushed loose and is sucked through barrel down into container.

cleaning a vacuum cleaner bag by an individual are well known. Multiply these by the hundreds and you have the problem which faces the motor shop specializing in the repair and servicing of vacuum cleaners. The work cannot be done outside because of the nuisance of the dust to the public. How to get the dirt, hair, lint and dust out of the bags and get rid of it long bothered Los Angeles Electric & Service until they designed and built this device that has a faint similarity to a modern machine gun.

Now, after dumping the main accumulation from the bag, the maintenance shop operators slip the opening of the bag over the end of the barrel of the "gun," throw a switch starting a partial vacuum in the barrel, and twirl the bag around until every part is thoroughly cleaned. It takes only two or three minutes. Hair, threads, etc., are removed by a revolving brush inside the barrel, the bristles of which work directly under a row of holes in the top of the barrel extending back about a foot from the closed muzzle. Air and dust are sucked from the bag, through the holes and into the barrel.

In constructing the device, they made use of a complete vacuum cleaner assembly, salvaged from partially damaged or worn out machines, fastened upside down as shown. The barrel of the gun is hermetically sealed to the vacuum cleaner element that ordinarily runs over the rug. When the cleaner is started, air is drawn back through the barrel of the gun, and discharged through the regular cleaner outlet into a 10-gallon container, being coupled to the latter by a tight bag as shown in the sketch. There must be an air release on the container, however, to permit the machine to operate. This is provided by an ordinary vacuum cleaner bag attached to an outlet in the container.

The revolving shaft carrying the brush at the end is turned by means of a connected pulley, a twisted belt driving it from a pulley on the end of the motor shaft. To give access to the belt, a section of the top part of the barrel, corresponding to the breech of a gun, is made removable.



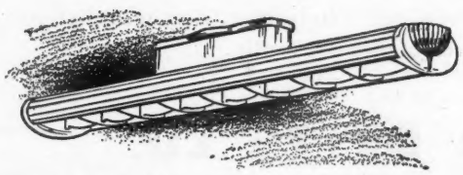
Outdoor lean-to provides adequate facilities for stripping and cleaning motors and other electrical equipment and for storage of numerous transformers at Fagan Electric Company's headquarters in Little Rock, Arkansas.

Virden Opens the Residential Fluorescent Market

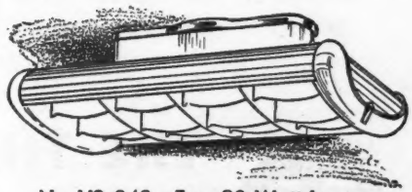
Virden's VS-224 featured above is smart—in a true sense.

It utilizes modern plastics and metals to achieve lightness, grace and beauty. That's smart—but while its designer had in mind a modestly deluxe kitchen unit, the public grasps a wider range of usefulness—that's smarter.

The public sees in these fixtures fluorescent lighting for dining room, bathroom or bedroom. They want fluorescent now. This fixture and its companion No. VS-242 make fluorescent pleasantly available at reasonable cost.



No. VS-224—Two 40-Watt Lamps



No. VS-242—Four 20-Watt Lamps

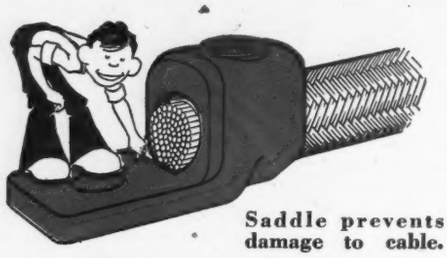
JOHN C. VIRDEN CO. • Cleveland, Ohio

Now Available

FOR EASY HOOK-UPS

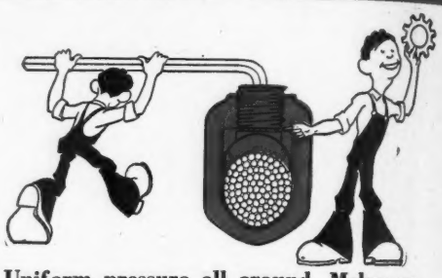
T&B LOCK-TITE *solderless* CONNECTORS

T&B LOCK-TITE LUGS
Take any kind of cable #4 to 1,000,000 CM.



Saddle prevents damage to cable.

Direct contact, high conductivity. Runs cooler than the cable.



Uniform pressure all around. Makes up tight, stays tight.

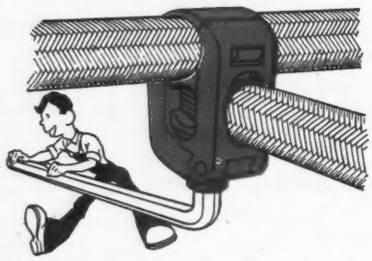
HINJON JR. TEE-PARALLEL TAPS
Tap all mains #8 to 1,000,000 CM to all branches #14 to #1, in all possible combinations.

Small. Compact. Easily taped. Single bolt applies tremendous all around pressures to both main and branch cables.

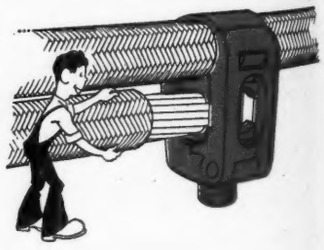
Quickly installed with screw driver or pliers. For tee taps, just bend branch to desired position.

LOCK-TITE TEE-PARALLEL TAPS
Tap all mains 1/0 to 1,000,000 CM to all branches #2 to 1,000,000 CM in all possible combinations.

This one piece Tap slips over your cables easily. Streamlined for easy taping.



Single bolt is quickly tightened with key wrench. Pressure that defies man-made vibrations.



Hangs by itself on main cable. Easy to install branch for either tee or parallel position.

Each T&B Lock-Tite Connector takes a wide range of cable sizes, and *all* types of conductors. Built-in engineering assures perfect electrical and mechanical connections. One piece compact construction makes them easy to install and tape. Approved of course by the Underwriters Laboratories. Order these economical, all-purpose T&B Lock-Tite Connectors from your nearby T&B Electrical Wholesaler, our sole distributor. He has them in stock and will fill your requirements promptly.

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Answered by
F. N. M. SQUIRES and GLENN ROWELL
Chief Inspector
New York Board of Fire Underwriters
New York, N. Y.
Electrical Engineer
Fire Underwriters Inspection Bureau
Minneapolis, Minn.

QUESTIONS ON THE CODE

SERVICE CONDUCTORS

Q. *When determining the proper size for service conductors, is it not correct to use the demand factors shown in the Code, times the total connected load?*—N.F.

A. Yes, the result of the demand factor as shown in Section 2203 multiplied by the total connected lighting load will indicate the capacity required for the service conductors if the total load consists of lighting only. If motors are also served, they must be separately considered as directed in Sections 4314 and 4316 and then added to the result obtained for the lighting load. Appliance loads in dwellings and range loads must also be separately computed. —G.R.

DEMAND FACTOR

Q. *"I have to wire for several two hp. motors, each of which drive a portion of a conveyor system. The controls of these motors are so interlocked that only certain portions of the conveyor system, and therefore only a certain number of these motors operate at any one time. This brings about a sequence of movements of the various portions of the conveyor. Do I have to figure conductor carrying capacity for all of the motors as though they were all to be in use at the same time or can I apply a diversity factor? Where is this found in the Code?"*—R.D.

A. The Code provides that where the inspection authority having jurisdiction has knowledge of the duty cycle or of the maximum demand of a group of motors, it may grant permission for the feeder conductors to be of less capacity than would be necessary to serve all of the motors if they were all to run at the same time. The Inspection Bureau should be given all of the facts in the case, and be requested to grant special permission for a reasonable demand. This is found in Section 4316 of the Code.—F.N.M.S.

AIR COMPRESSION INSTALLATION

Q. *"I have been asked to install a motor driven air compressor in the basement of a garage. The basement is used for auto storage and is connected to the main floor by a ramp. The air compressor is equipped with a totally enclosed motor, but there is some question as to whether or not I may install it. I have been told that the motor and its controls must either be four feet above the first floor level or be explosion-proof. Is this a Code requirement?"*—M.C.K.

A. The totally enclosed motor may be located within four feet of the floor, but the controls will have to be mounted at least four feet above the floor unless they are also totally enclosed or are of the Class I Group D type. This ruling will be found under section 5103 of the N. E. Code. Under paragraph c of this section you will find that all other equipment which tends to produce arcs or sparks such as cutouts, switches, receptacles, fixed lampholders and charging panels must be of the Class I Group D type if located within four feet of the floor. The Code does not state that all electrical equipment located below the ground floor must be explosion-proof. Therefore a basement should be treated just the same as any other floor in a garage. The national standards governing garage construction require ventilation amounting to one cubic foot per minute for each square foot of floor area for basement and sub-basements used for the storage of automobiles. These same standards prohibit the use of basements for repair shops or filling stations so concentration of gasoline vapors in these below grade floors should not be serious enough to warrant the entire area being considered as a Class I location.—G.R.

The official family of the Southern Section, IAEI, recently elected at the Dallas Texas convention: (Seated L to R), Roy Speights, Richmond, Va., chairman, executive committee; M. G. Folkes, Richmond, Va., first vice president; A. M. (Gus) Miller, Richmond, Va., secretary-treasurer. Standing from L to R are: past-president E. C. Knox, Miami, Fla.; second vice-president B. Z. Segall, New Orleans; and executive committee members C. V. Porbes, New Orleans, and A. E. Hancock, Austin, Texas. Absent from the photo are the new president G. M. Ross, Sheffield, Ala. and executive committeemen C. S. Whitaker, Durham, N. C.; and L. A. Turnage, Hartsville, S. C.

TAPS

Q. *"If we make short feeder taps, less than five feet away, must we use wire having a carrying capacity of one-third that of the feeder?"*—G.K.

A. Not necessarily. If the tap has a carrying capacity not less than the sum of the carrying capacities of the circuit wires which it supplies, and does not extend beyond the enclosure of the devices which it supplies, and is in conduit or metal gutter, the conductors of the tap need not be one-third the size of the supply conductors.—F.N.M.S.

TYPE T CONDUCTORS

Q. *"There is considerable misunderstanding around here concerning the number of type T conductors which may be pulled in conduits on new work. I have been unable to find anything in the Code which even gives permission to use these new conductors on new work, yet it is just about the only*

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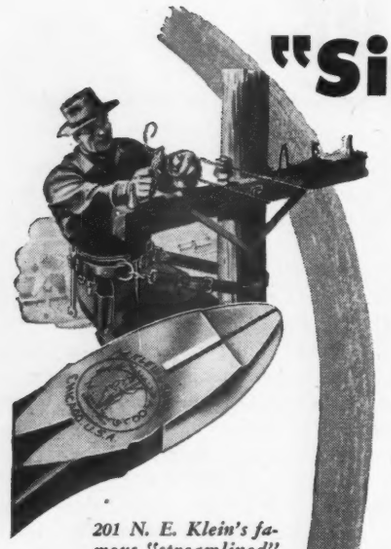
choice of utilities

"Since 1857"



201 N. E. Klein's famous "streamlined" Side Cutting Plier. Made in four sizes, 6, 7, 8 and 9 inches.

The first pair of Klein Pliers ever made was designed for the Public Utility field. Since that time, serving Utilities has been our major business.

Today Mathias Klein and Sons produces a complete line of pliers to cover every need of linemen and electricians. All have the extra stamina—the plus quality that electrical service demands. That is why Kleins are standard equipment with Public Utility Companies today as they were when the first wires were strung.

ASK YOUR SUPPLIER

***Foreign Distributor:* International Standard Electric Corp., New York**

This book on the care and safe use of tools will be sent on request.

301 Klein Long Nose Plier. The long reach of the jaws permits getting into difficult places. Made in 6 and 7 inch sizes.

242 Klein Oblique Cutting Plier (heavy-duty pattern). A very useful tool that cuts close. Length 6 inches.

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kind of insulated wire a person can buy. Some of the salesmen have suggested that we use the 40 percent rule and others have referred us to table No. 7 in the Code. Are there any definite rules covering this question?"—H.M.

A. This has probably been the most confusing problem faced by many contractors. The original 1940 Code limited the use of type SN conductors to the rewiring of existing buildings. Interim Amendment No. 46 approved May 7, 1942 removed this restriction and permitted the use of type SN conductors (now known as type T) in both new and old work. This amendment to the Code apparently reached a very small percentage of the electrical contractors, so for their benefit the complete text is as follows: "For the duration of the War Emergency: Conductors having 90 percent unmilled, grainless rubber insulation (Type RU) and conductors having flame-retardant, moisture resistant solid synthetic insulation (Type SN) may be used wherever Types R, RP and RH rubber insulated conductors are acceptable. For the duration of the War Emergency Type RU conductors in sizes No. 14 to 10 inclusive and Type SN conductors in sizes No. 14 to 8 inclusive when used for new work in raceways shall be installed in accordance with table No. 6 on page 308. Type SN conductors in sizes No. 6 to 4/0 inclusive when used for new work in raceways shall be installed in accordance with table No. 4 as amended."

Now it must be remembered that this amendment to the Code was adopted when steel was critical and the use of steel conduits was drastically limited by the WPB; so even though this interim revision will technically be in force until the effective date of the 1946 Code, the use of table No. 6 on conductor sizes 14 to 8 inclusive will greatly limit any

Attending recent Western Section, IAEI meeting were Canadians W. C. Cale (left) approvals engineer, Canadian Standards Association, Toronto; and E. W. McLeod, assistant chief electrical inspector, Hydro Electric Power Commission of Ontario.

possible future expansion in capacity. The 1946 Code will require use of table No. 4 for all type SN or T conductors sizes 14 to 4/0 inclusive, and it would seem only fair that table No. 4 be the only one used in the interim unless the installation under consideration is for short time use and will definitely be replaced or removed within a specified time.—G.R.

LINE AND LOAD WIRES IN SAME CONDUIT

Q. *"Can we put line and load wires in the same conduit or trough?"* —G.K.

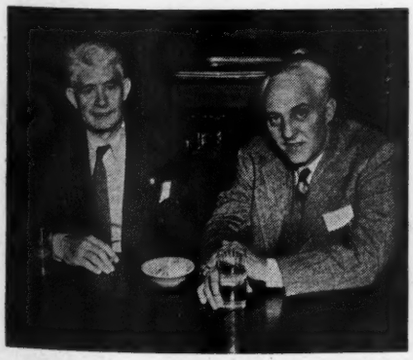
A. Yes. See Section 3013. Load and line wires are of the same system and placing them within the same conduit would not violate the present code nor would it have violated previous codes, which used to prohibit wires of different systems being run within the same conduit.—F.N.M.S.

BARE INSULATION GROUND WIRE

Q. *"I would like to get an interpretation of whether or not it is proper to run No. 8-1-BX bare insulation ground wire on the outside of a building, fastened with staples.*

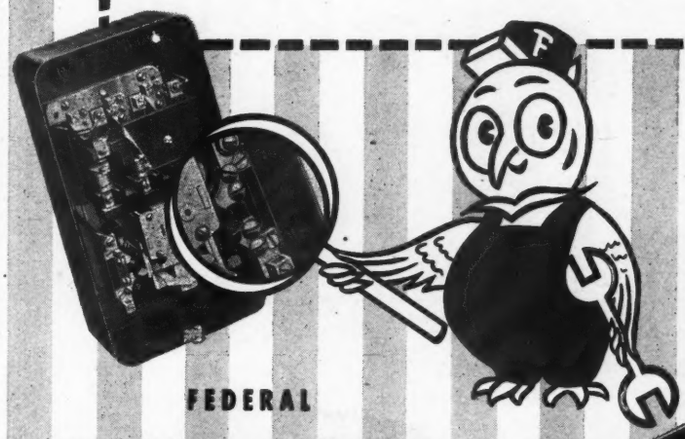
"If so, does this meet requirements of the Code so far as mechanical injury is required?"—H.F.F.

A. Our answer to this question is found in Section 2592. There, we find that a No. 4 or larger grounding conductor may be fastened (by staples or otherwise), to the surface on which it may be run without the use of any type of insulation and without mechanical protection, unless subject to severe injury. Also, that a No. 6 if not subject to any degree of mechanical injury, may also be stapled (rigidly) to the surface, but if subject to mechanical

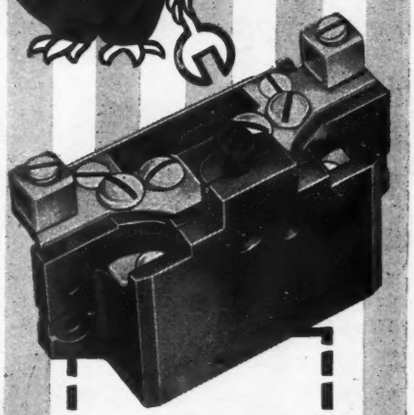


Prominent in electrical industry activities at DesPlaines, Illinois, are Arthur Rieck (left), city electrical inspector and Charles A. Johnson, Johnson's Electric Shop.

FOR FOOL-PROOF SAFETY EVERY TIME
IN CUTTING MOTORS FROM THE LINE,
THIS FEDERAL RELAY DOES THE TRICK
WITH THOSE WHO KNOW—
IT'S BOUND TO CLICK!



FEDERAL
OVERLOAD RELAYS
STANDARD EQUIPMENT ON
Federal NOARK
MAGNETIC
MOTOR STARTERS



Wherever overload protection is needed . . . whether on new or existing installations . . . Federal's Overload Relays will provide the "plus-margin" of dependability generally associated with Federal products. Naturally, these relays are built into Federal Noark Magnetic Starters . . . but remember, too, that they're available for your special applications. Federal Overload Relays provide conveniently located load and control circuit terminals, often making additional terminal blocks unnecessary.

DESIGNED FOR AUTOMATIC OR MANUAL RESET

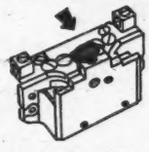
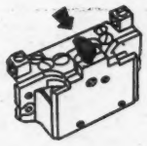


Diagram shown above illustrates Plunger (arrow) set for "automatic" reset.



Plunger is set for "hand" reset in above diagram.

FEDERAL ELECTRIC PRODUCTS COMPANY, INC.
EXECUTIVE OFFICES: 50 PARIS ST., NEWARK 5, N. J. - PLANTS: HARTFORD, CONN. - NEWARK, N. J.

The INTER-MATIC TIME SWITCH is Well Engineered

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REMOVABLE DOOR

You CAN remove the door from the INTER-MATIC easily. It's only one of the many important features which make the INTER-MATIC a well designed unit.

WITH THE DOOR REMOVED

—You can mount the INTER-MATIC easier
—You can set and reset the timings more readily
—You can make the wiring connections with less trouble

WRITE FOR CATALOGUE AND NAME OF NEAREST DISTRIBUTOR

$7.50 LIST
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115 V., 60 Cycle

INTERNATIONAL REGISTER CO
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injury must have protection against the mechanical injury, which protection may be in the form of cable armor.

We also find in the same section, that grounding conductors smaller than No. 6 must be provided with protection in the form of conduit, electrical metallic tubing or *cable armor.*

The cable armor, then, provides protection against mechanical injury and founding conductors so protected may be stapled to the outside of a building.—F.N.M.S.

SWITCH RATING

Q. *"What would be the total capacity of a switch rated at 200 amp. 115-230 volts? Does a 200 amp. 115-230 volt switch mean 200 amps. per side and center?"*—R.W.C.

A. A switch as described above, has a rating of 200 amps. per blade. That is, it has a rating for 200 amps. at 230 volts, using the outside blades, or for 200 amps. at 115 volts on each side.

A switch rated at 400 amps. should be capable of carrying a load of 200 amps. continuously, whether it is of the fused or unfused type, or whether open or enclosed. Experience has taught us, however, that the present 200 amp. switches, if enclosed and fused, cannot successfully carry a continuous load of 200 amps.

Let us hope that some day all switches will be capable of carrying their rated loads. For the present it is best to order an oversized one.—F.N.M.S.

RURAL WIRING

Q. *"I have wired my first farm and have received a rejection slip from the inspector because I pulled the yard light control wires through the*

Michael Friman and Al Duff, partners in the Associated Electric Company, Chicago contractors, discuss installation techniques with F. P. Stocker (right), wiring inspector, Commonwealth Edison Company, Chicago.

same conduit containing the feeder circuit for the barn. This conduit was of ample size, but apparently I have violated some other provision of the rules. Is there a Code rule which prohibits a feeder and circuit conductor from occupying the same raceway?"—M.L.

A. On a large percentage of farm properties each major building contains its own service equipment and while the yard pole does have a meter and switch mounted on it, this equipment should be classed as a switched meter loop and not as a master service unless a distribution panel providing overcurrent protection for each set of outgoing feeders is also mounted on this same pole. If the yard pole on the farm you are interested in has only the usual switched meter loop on it, the so-called feeder conductors for the barn should be considered as service conductors and section 2308 of the N. E. Code would prohibit placing the yard light control wiring in the same raceway. This section states that conductors other than service conductors, grounding conductors or control conductors for time switches having overcurrent protection shall not be installed in service raceway.

If on the other hand the conductors serving the barn were provided with proper overcurrent protection either at the yard pole or some other distribution point between the source of supply and the raceway on the barn, they may be considered as feeders and not service. The Code will not prohibit placing feeders and circuit or yard light control conductors within the same raceway provided all conductors have an insulation suitable for the highest voltage used within the common raceway.—G.R.

SWITCHES

Q. *"When must we have branch lighting switches at cabinets?"*—G.K.

A. The Code does not require that switches be used on branch lighting circuits. Convenience however, dictates the use of switches.

As far as the Code is concerned, we could leave switches out of branch lighting circuits and leave the lights burning all of the time or pull the service switch to put them out, or turn the lamp bulbs in and out of the sockets to turn the lights on and off.

Happily, however, nobody would want to get along with this arrangement, so switches are installed for the users' convenience. There is no doubt however, but that the Code should make some specific requirement in regards to this matter.—F.N.M.S.

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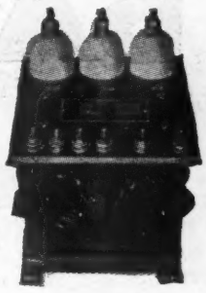
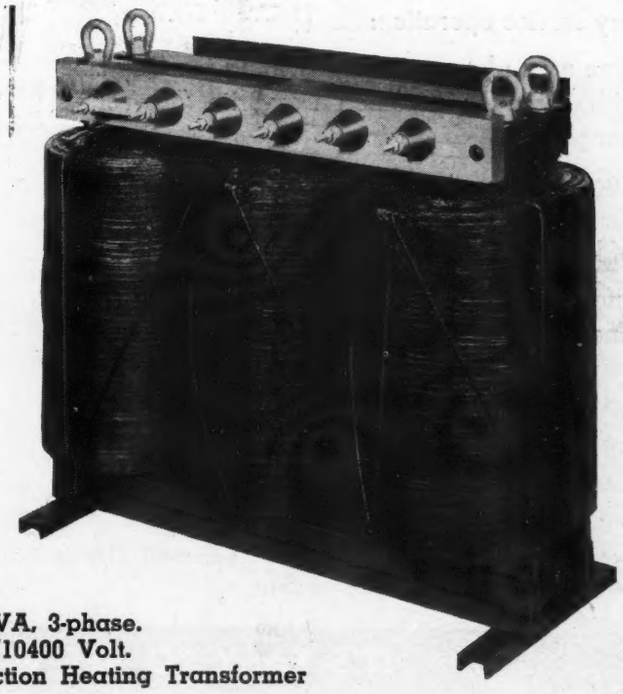
¼ to 1000 KVA. All voltages.
Single phase and poly-phase.



Special Electronic Device Transformer



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The "ONE-MAN" *Fixture*

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* Patent Nos. 2317434, D135375, D133458

944

IT'S EASY TO SEE WHEN IT'S

DAY-BRITE *Lighting*

MODERN LIGHTING

CONTINUOUS FLUORESCENT FOR UPHOLSTERY DEPARTMENT

When the Fisher Body Division of General Motors Corporation reconverted its Flint, Mich., plant to auto body production, a new electrical system was installed in the revamped upholstery department. To provide the necessary flexibility in power distribution (equipment grouping must be rearranged for various production schedules), two continuous lines of 250-amp., 40-volt, 3-phase, plug-in type distribution bus duct were installed parallel to the length of the 900-ft. by 80-ft. "room." These are so located that they will serve all the cutting and sewing equipment in whatever groupings may be required for the schedule at hand.

The possibility of equipment rearrangement also dictated the installation of a high intensity general lighting system, one that would eliminate the need for numerous localized lighting units. Previously, an average general lighting intensity of 15 to 20 footcandles was provided by 300-watt, glassteel diffusing incandescent units on 10-ft. by 10-ft. spacing and a 11-ft. mounting height. The new installation was designed to give more than double this intensity.

Continuous rows of industrial type fluorescent units (two 40-watt 3500 degree white lamps per fixture) are installed on 10-ft. centers, two rows per 20-ft. bay. Fixtures are chain suspended from the flat concrete ceiling at a 10-ft., 6-in. mounting height, bottom of reflector to floor. With the ceiling and upper half of the columns and walls painted white, the eight rows of fluorescent units provide an average *maintained* intensity of 35 to 45 footcandles on the 30-inch working plane.

The resultant cool, shadowless high intensity lighting is particularly desirable at the cutting tables and sewing machines where the seeing task is especially critical. Fewer slips of the cutting blade and machine needle means a considerable saving of cloth. Coupled with the reduction of employee eye fatigue, this adds up to greater efficiency in the department.

Use of continuous equipment follows the new trend to lines of light, which is neat appearing and produces a uniform lighting result.

MERCURY-INCANDESCENT SPEEDS SEEING

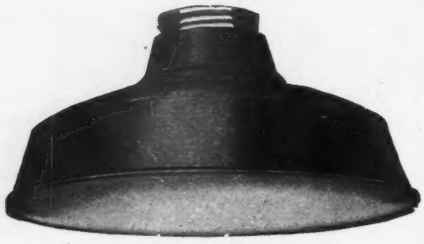
Botwinik Bros., New Haven, Conn., were awarded the Army-Navy "E" for outstanding performance in rebuilding machinery and producing machine tools, during the war. Good lighting played an important part in this program. The entire plant was relighted to a uniform intensity of 30 footcandles, using a combination of mercury and incandescent units, to provide a good color quality of illumination for the type of work performed in this plant.

The building is 640 feet long. It consists of a high bay area which is 63 feet wide, and an adjoining low bay area which is 41 feet wide. The ceiling height to bottom of truss in the high bay area is 29 feet 6 inches, and in the low bay area is 20 feet. Outlets in the high bay area were spaced on 13 foot 3 inch by 15 foot centers. Outlet spacings in the low bay area were on 20 foot centers.

Alternate outlets in both areas were equipped with 400 watt mercury high intensity lamps in porcelain enameled reflectors. The other outlets were

Adequate lighting, planned for the critical seeing tasks of "cut and sew" section of Fisher Body's upholstery department, boosts general over-all efficiency. Continuous rows of fluorescent units provide a maintained intensity of 35-45 footcandles in this revamped area of the Flint plant.

RLM Heavy Threaded Deep Bowl Reflector and Socket Hoods



RLM Threaded Dome Reflector

RLM

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Manufacturers of Incandescent Lighting Equipment

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Incandescent lamps are combined with high intensity mercury lamps, on alternate outlets, to provide excellent color quality illumination of 30 footcandles at Botwinik Bros. metal working plant, New Haven, Ct.

equipped with 750 watt incandescent lamps, also in porcelain enameled reflectors. Because of the mounting height of the units, approximately one foot above the bottom of the steel trusses, the work area receives light from both mercury vapor and incandescent units. The blending of the illumination from these two types of light sources results in a high quality light, having a high value for seeing detail in iron and castings.

Miller Company porcelain enameled steel reflectors were used on this job. It was engineered by Frederick M. Hill, electrical engineer of New Haven.

PLANNED LIGHTING ACCENTS JEWELRY

Modern lighting attracts attention to the silvered lustre and jeweled brilliance of showcases in Michaels, New Haven, Conn., jewelry store.

The store, measuring 27 by 84 feet, has a hung cove ceiling at a height of 10 feet with the main ceiling 10 inches above. Blue fluorescent tubing diffuses linear light from the coves to the celestial blue central ceiling and augments the sparkle of gems. Incandescent 300-watt display lamps, recessed in the cove ceiling on 8 foot 6 inch centers, shine through circular flush-mounted prismatic glass plates to highlight metal mellowness. Venturi-flow air conditioning units mounted over the central aisle incorporate light from 300-watt lamps. Standard showcase lighting in running overhead troughs locally illuminates the 40½ inch high display counters and the glass-shelved wall cases recessed in the side panels of bleached mahogany. Window displays are accented by overhead 200-watt tungsten lamps behind glass prismatic plates. This lighting effectively enhances quality merchandise.

The lighting plan was designed by Frederick M. Hill, New Haven consulting engineer, who worked in conjunction with the architects, Norton and Townsend of New Haven and Charles Telchin of New York City.

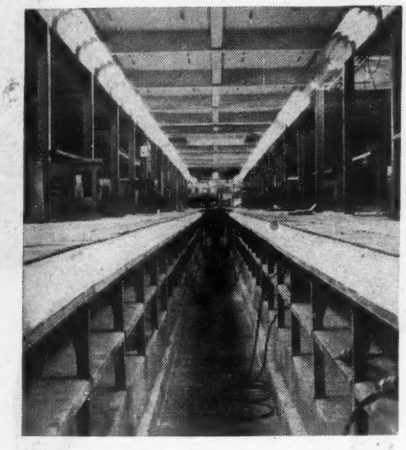
Fluorescent cove lighting and direct incandescent illumination through circular glass prismatic plates are features of this jewelry store which also utilizes luminous overhead air conditioning units and local showcase lamps housed in continuous troughs.

LIGHTING THE AUTOMOBILE ASSEMBLY LINE

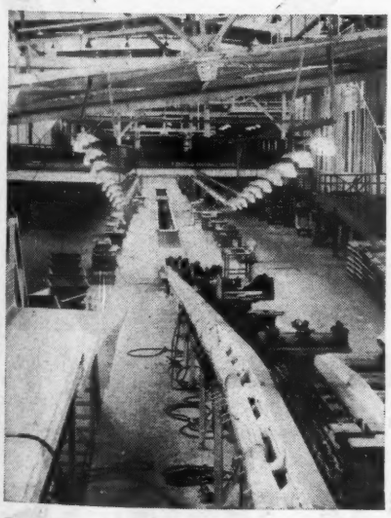
The speed at which automobiles can be assembled depends, to a considerable extent, upon the quantity and quality of lighting under which the assembly line employee works. Inadequate lighting leads to lost time and poor workmanship conditions that cannot be tolerated if production schedules are to be met.

Realizing this, engineers of the Buick Motor Division, General Motors Corporation at Flint, Mich., planned their lighting accordingly when the plant was reconverted to peacetime production. In general, lighting intensities were boosted from the old 10-15 footcandles to a minimum maintained intensity of 35, with RLM fluorescent units using two 100-watt lamps.

Typical of the *planned lighting* in the plant is the "over and under" lighting scheme installed on the final assembly line. As the assembled cars come down

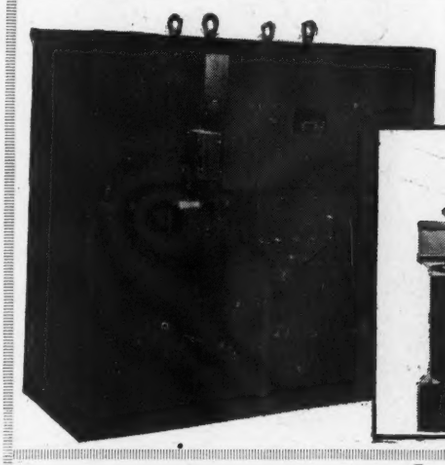


Pit, lighting, 40-watt, single-lamp fluorescent units with wire guard for under-car work and inspection at Buick plant. Note continuous row of overhead titled units for lighting top and side of cars.

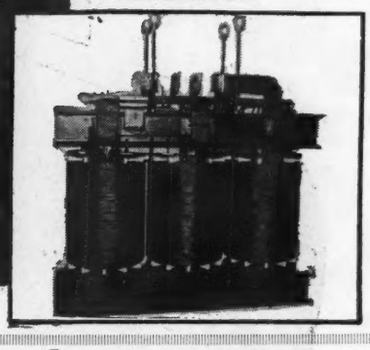


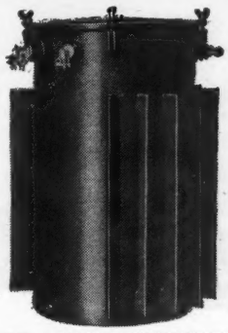
Looking down the final assembly ramp at Buick's Flint plant. Note trestle lighting and graduated mounting height of overhead lighting units.

DAVIS TRANSFORMERS



CLASS "B" DRY-TYPE LOAD CENTER UNIT-SUB
500 KVA, 60 Cycle, Three Phase, 2520-208Y/120 Equipped with Load Break Isolator.





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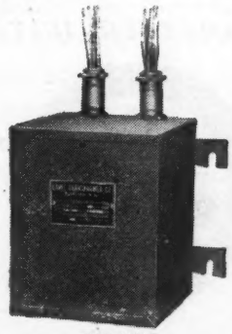

DRY-TYPE
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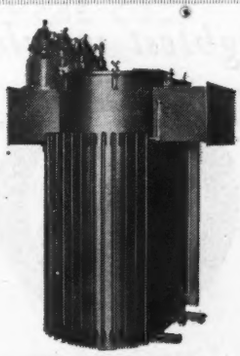

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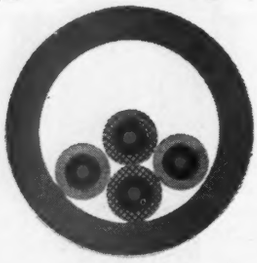
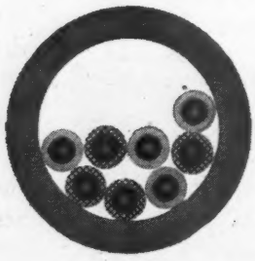
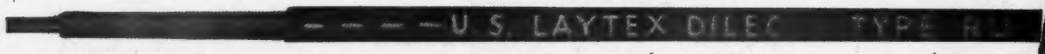


Conventional insulated wire, four No. 14 (code) type R conductors. 3450 watts.



Laytex insulated wire, eight No. 14 Laytex insulated conductors — 5800 watts.



A well lubricated fibrous cover protects Laytex against light, air and abrasion. Cover is also flame-retardant, moisture-resistant.

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The man who uses Laytex will find it clean stripping, easy to install or remove. Permanent colors make circuit identification easy.

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A variety of mounting styles, types and designs to meet every installation limitation. Underwriters Laboratories approved. Performance tested.

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TRANSFORMERS

The end of the line where cars get their final rubdown. Continuous rows of tilted RLM fluorescent units, two 100-watt lamps each, suspended from angle iron frame, provide the necessary horizontal and vertical illumination.

the conveyor ramp to enter the final check-up lane, employees work both under the car and "topside." To illuminate the underside of the car, single-lamp, 40-watt, fluorescent units, enclosed in a protective wire mesh guard, are mounted to each side of the conveyor trestle at "track" level. These units are just inside the wheels as the car comes down the incline and provide adequate illumination to check wheel rotation. Wheels extend beyond trestle and do not touch ramp, spring, steering and other connections.

Ramp overhead lighting is provided by a row of RLM fluorescent units, each with two 100-watt lamps, on each side of the conveyor. The fixtures are suspended from an angle-iron frame which also supports the trolley duct circuit feeding the units. Each fixture is tipped at approximately a 45-degree angle to provide vertical as well as horizontal lighting on the car body. As the ramp elevation decreases, the mounting height of the units is reduced so that each fixture is the same distance above the car as it approaches floor level.

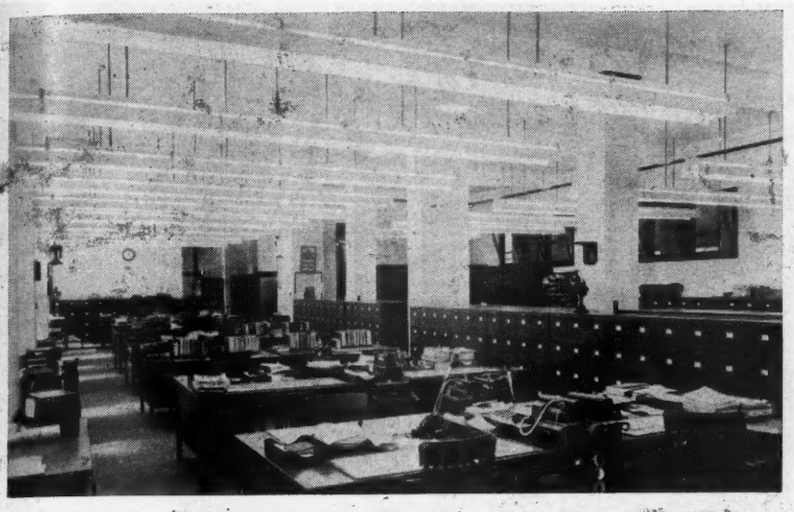
Once the car is on the floor, it is on its own and goes over a long pit where employees give the under side a final check, tightening all bolts, lubricating joints, etc. Here again, pit lighting is provided by 40-watt, wire-mesh enclosed fluorescent units having the same relative position, with respect to the car, as those on the ramp trestle. The fixtures, mounted in a right angle offset directly above the parts and tool bins of the pit, top of units flush with floor level, provide ample light for the pit bins and under-car work.

Overhead lighting above the pits and beyond, where the cars are given the final polish and driven off the line, follows the pattern at the ramp. A line of tilted units mounted almost end-to-end on each side of the line provides a veritable tunnel of illumination through which the cars pass. A long angle-iron frame, suspended from the high ceiling by steel cables with turnbuckle adjustments, supports the trolley duct and fixtures.

OFFICE EFFICIENCY RISES WITH ILLUMINATION

Realizing that modern lighting complements the accuracy, productivity, health and morale of the office worker, the Pennsylvania Railroad Company has redesigned the lighting plan in their Traffic Department office in Chicago's Union Station building. With double desks at right angles to twin rows of filing cabinets, employees habitually face in four different directions so it was advisable to establish a high level of general, non-directional illumination to insure shadowless, glareless lighting on both horizontal and vertical planes.

The ceiling height of 13 feet 6 inches made it possible to suspend continuous runs of fluorescent fixtures 9 feet 6 inches above the floor. At this level nearby lamps are placed a sufficient distance above normal eye elevations to cancel glare from source brightness and louvres become non-essential. This permits the maximum amount of useful light to pass downward and reduces the maintenance factor of the luminaires. Spacing the lighting troughs on seven foot centers and selecting fixtures that permit partial illumination of the ceiling results in increasing overall brightness, minimizing contrast between lamps and background, eliminating shadows from ceiling beams and reducing the glare factor.



Continuous runs of open semi-direct Futurliters are suspended on seven foot centers. Desk top illumination is 60 footcandles, provided by 2.5 watts per sq. ft.

An average intensity of 60 footcandles at desk level was reported after 200 hours of service. The office contains 97 Guth 2 lamp 40 watt Futurliters, each unit 4 feet in length, and has a power consumption of 2.5 watts per sq. ft. With this data the coefficient of utilization, theoretically computed, is 40 percent. The design was executed by G. A. Hall of Chicago.

STUDIED LIGHTING COMPLEMENTS MATERIALS AND CUSTOMERS

Lighting has always been a prime selling factor, although department stores have rarely exploited this fact to the fullest possibility. A sound choice of lighting equipment, technique and color application will return handsome dividends to those realizing that sales resistance fades as a customer's self esteem rises. Utilization of *planned lighting* in clothing stores emphasizes texture and design of wearing apparel by stepping up intensities of illumination. The careful selection and blending of color can flatter skin tones. Customers, trying on new dresses or suits and studying the effect reflected from properly illuminated mirors are pleased with the image.

Women of Rochester, New York, shop under these modern conditions at McCurdy's. Surface mounted fluorescent fixtures provide a combination of squares and continuous lines of light that maintain a general counter illumination between 30 and 35 footcandles. Soft white and 3500 degree light blend to bring out the warmth of skin textures as well as the weave of woolens. Holophane fixtures break the continuity of straight runs and add sparkle by intermittently raising average intensities. Attention is drawn to models and special counter displays by local spot and floodlights. Recessed lighting above dresses in the curved wardrobe cases is designed to invite examination of the racks. Light colored ceilings, walls and columns, floor carpeting and counter woodwork augment the lighting plan, providing a restful, high key sales environment.

Fluorescent runs and squares, Holophane units, recessed rack illumination and display spotlights promote satisfaction and sales.

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Where there is a possibility of fire, or other disaster from a spark, exposed flame, heat or breaking of bulbs, then McGill Vaporproof Lamp Guards should be used on all portable or extension lights. The tight-sealing globe and heavy cage, with air-tight seal in handle opening, eliminate these hazards at every spot where this guard is used. These Vaporproof guards are designed to stand up under roughest use and abuse.

These guards also protect the light bulb and prevent breakage when used around machines where water and oil might splash on the bulb. Guards also are grounded — an additional safety feature.

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WHAT CAN ELECTRONICS DO IN YOUR FACTORY?

The chances are there's at least one job it can do better and cheaper

ELECTRONICS is by no means the answer to every industrial problem. The fact is that many jobs are done with less fuss and expense by other means.

But, electronics is quicker than the eye and hand, is infinitely more observing, and can repeat precision operations indefinitely—and faster—without fatigue. Moreover, electronic power can perform intricate heating and welding jobs in less time than it takes to tell it. Any one of these operations done electronically adds up to a greater production of higher quality products at less cost.

The upshot is that electronics has stepped out of its role as an untamed miracle and become an important business proposition. If you have not reviewed its possibilities as an industrial tool, now is the time to consider its potentialities.

Some of the Jobs Electronics Can Do for You

- Heating metals, plastics and wood
- Timing welding and control operations
- Controlling manufacturing and processing operations
- Regulating motor speed
- Converting alternating current to direct current
- Inverting direct current to alternating current and changing the frequency of alternating current
- Counting, sorting and weighing manufactured or processed products qualitatively or quantitatively
- Inspecting finished products nondestructively
- Measuring product specifications
- Analyzing product characteristics
- Protecting workers against injury

THIS WILL CONVINCE YOU

The free booklet *"16 Examples of RCA Electron Tubes at Work in Industry"* will prove convincing. Write for it today on your company letterhead and address your request to Radio Corporation of America, Commercial Engineering Department, Section I-8B, Harrison, New Jersey.

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PRACTICAL ARTICLES on the application, installation and maintenance of electronic apparatus in industry. Readers are invited to contribute items from their experience to this department. Articles used will be paid for.

ELECTRONICS

THE SERVO SYSTEM

George O. Smith

Controlling the position of heavy members from a remote station is a proposition that has been clarified and reduced to a science. With the setting of small, low-torque dials in a housing hundreds of feet away, the entire primary battery of a battleship may be trained to the precise angle necessary to hit a target at twenty miles. The "Big Glass" of the Mount Palomar telescope is equipped with similar systems. From the operator's position in the tube-housing high in the observatory dome a series of dials may be turned. The telescope will move automatically, changing in right ascension and declination to train upon the minute area of the sky selected by the operator. The big dome will revolve automatically so that the observation-slit will line up with the line of sight. Since the "Big Glass" is equipped to be used, through a train of mirrors, in several widely separated observing positions, the use of a synchronized servo system will enable the operator to set the telescope from whatever position he is working. The dials will automatically follow throughout the observatory so that the angle of the telescope may be read from any of the other dials.

If for "gun-turret" and "Telescope" the words "Crane" or "tool-machine" are substituted, the use of a servo system becomes practical for commercial use. The servo system that will train 200 tons of gun turret or telescope mount will certainly manipulate the heaviest gantry crane. Juggling a heavy driveshaft into position with a gantry crane by the old methods seems crude by comparison. The motor-controllers with the problem of hand signals to raise the hoist an inch, or to move the traverse an inch, requires a careful hand on the controller. Compare this to watching the operation from the best angle, and setting dials

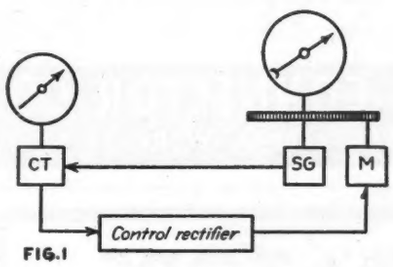


FIG. 1

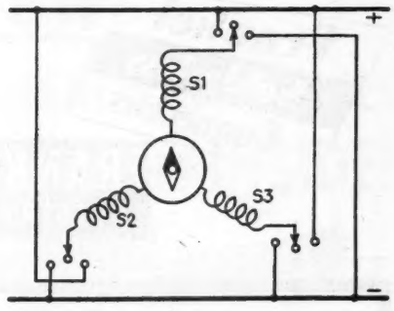


FIG. 2

calibrated in fractions of an inch and seeing the shaft move precisely that distance.

When the position-data is transmitted along a wire, the separation between controller and controlled may include several moving or sliding elements, since an electrical connection may be simply made with slip rings. There is no comparison between this and a complicated series of shafts, differentials, gears, and levers.

The translation of position to electrical data is made possible by the synchro. The term "Synchro" is used to cover four types of self-synchronising, rotating electro-mechanisms. They are: Generator, that translates the position of its shaft into electrical data; motor, which will follow (at low torque) any change made in the generator; control Transformer which develops a voltage output as a function of the difference between the position of its shaft and the shaft of the generator; and differential generator which when inserted in the data-line between generator and motor or control transformer will add or subtract the angle of its shaft with respect to the electrical data. This introduces

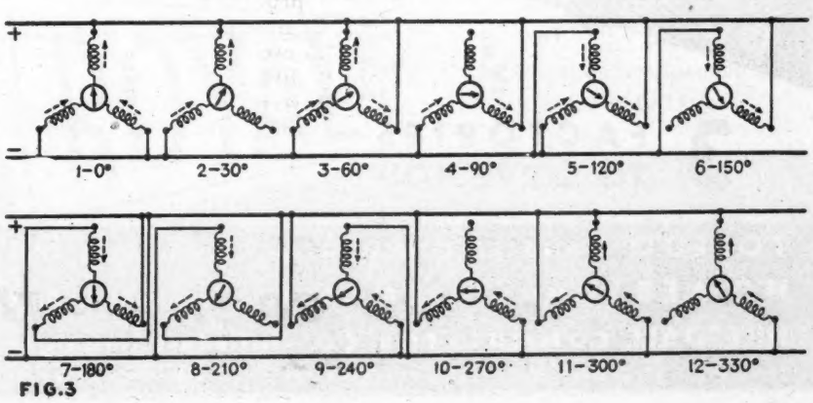
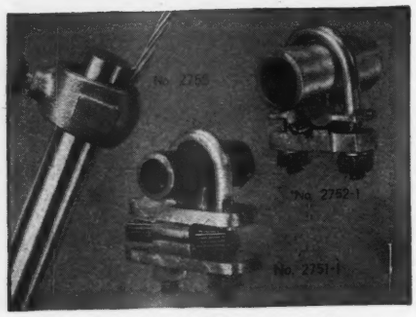


FIG. 3

Frankel
GROUND CLAMPS



Typical Frankel Ground Clamps

For grounding one, two, three or more cables to pipe, angle iron, steel plate or ground rod. Clamps are of high conductivity bronze with Everdur hardware. Catalog 4C describes and illustrates a wide variety of Frankel Ground Clamps and other Solderless Connectors. This catalog can be of real value in helping you layout your grounding and wiring work. Write for your copy.

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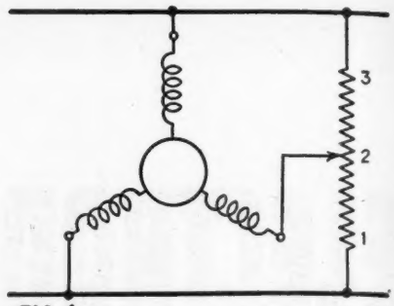


FIG. 4

a constant difference between generator and motor or control transformer.

The most simple servo system consists of a synchro-generator, a control transformer, a control rectifier, and a driving motor. The latter is not a synchromotor. The diagram in Fig. 1 shows such a system. So long as the angle of the generator G agrees with the angle of the control transformer CT, no voltage output comes from CT to the control rectifier. The latter amplifies any voltage and utilizes the power output to drive the motor M; since the agreement results in no-operation of the control rectifier, the motor is not energized and the system is immobile. When the control transformer is turned, however, the agreement no longer exists between it and the generator. A voltage appears across the control transformer output which enters the control rectifier. The latter amplifies this voltage and uses the amplified voltage to control heavy-current thyratrons which energize the motor. The motor now will drive the mechanism until it agrees in position with the control transformer. The agreement results in zero output and the motor then stops.

The manner in which the synchro translates mechanical position into electrical data is not complex, though it is often obscured because the main principle is not clear from inspection, either of the synchro itself or of diagrams. Essentially, the synchro is an electrical transformer with a mobile primary. The synchro generator measures the magnetic field set up by the rotor, and sends the data to motor or control transformer, where the data is used to reproduce the conformation of the magnetic field in the generator. In the motor, the rotor is driven electrically to align itself with the magnetic field; in the control transformer the rotor is not energized, but merely acts as a transformer secondary to develop voltage across its winding when its mechanical alignment disagrees with the magnetic field induced in the stator by the generator.

Positioning may best be shown by using direct current. Three electromagnets, a small compass, and a battery connected as shown in Fig. 2 will produce twelve basic positions. These positions are shown proper in Fig. 3. To

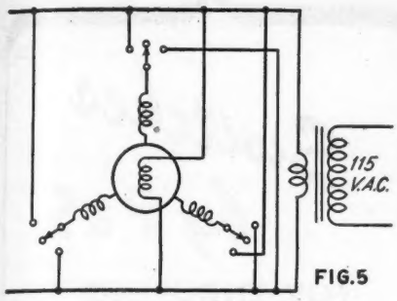


FIG.5

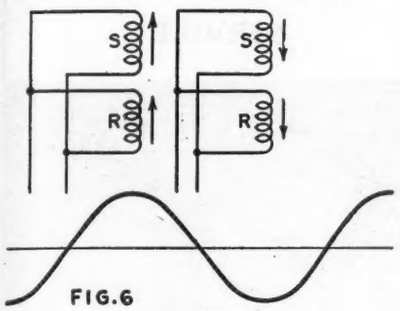


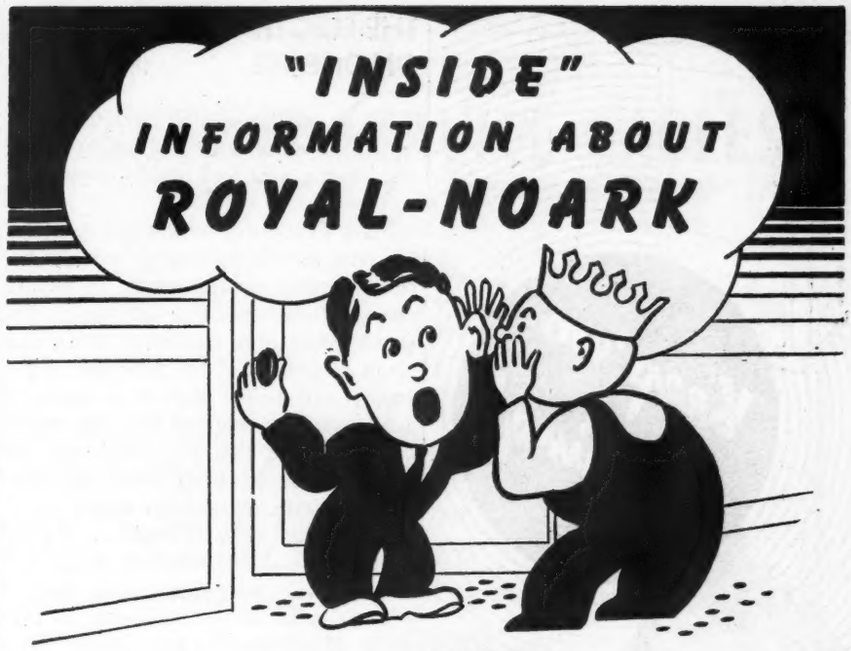
FIG.6

cover intermediate positions, the electromagnets must be energized by less than the full voltage of the battery. A potentiometer connected as shown in Fig. 4 will cause the compass needle to cross smoothly through Position 1 to Position 3.

This is a crude synchro, but it shows how mechanical position can result from electrical data. The first step in refinement is a change from direct current to alternating current. This requires that the compass be replaced, since the compass is an indicator of a constant magnetic field only. Under the influence of alternating current it not only does not work, but will become useless since the alternating magnetic field will demagnetize the compass. Electromagnets from door-buzzers are used—the compasses are the Woolworth variety and therefore expendable.

With alternating current in the system, it is no longer possible to think of magnetic polarity. The indicator must, however, be in synchronism with the alternating magnetic field. A fourth electromagnet will serve as the rotor, and if suspended and connected as shown in Fig. 5, the same basic twelve positions are possible. Since the rotor winding is energized by the same current as the stator, its magnetic field alternates as the field, and for any instant, the direction of the current through both are alike. Fig. 6 shows the maxima and minima of an alternating current and the direction of current through the coils at both instants.

This experiment is less precise due to the friction introduced by the magnet-bearing and the wiring. The next step cannot be shown by the simple set-up because of the inherent inefficiency of the experimental equipment. The next article is this series will develop the individual elements of the syncho-system.



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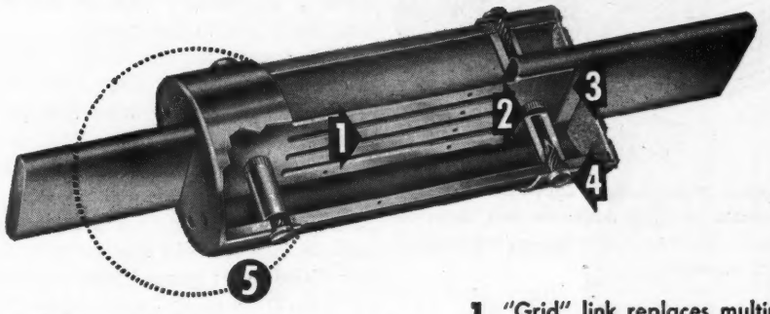

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THE ELECTRICAL WAR ON DISEASE

[FROM PAGE 89]

lished in small towns all over the country to serve the town and nearby farmers, offer a new and rapidly expanding market.

Food Processing—Although processing with germicidal energy will not recover spoiled canned goods, lamps are already being specified for use in the sugar refineries of companies processing about 85 percent of the American sugar supply. It enables them to produce, at a fraction of a cent per bag, the special canner's sugar that previously cost ten cents per bag when sterilized less satisfactorily with superheated steam.

Food Packaging—Despite a limited operation to the disinfection of air and of surfaces, germicidal lamps are of general value in the packaging of products which must be kept sterile. One application prevents contaminated air from infecting milk bottles from the time they leave the washer until they are filled, sealed and capped. One company in a similar fashion prevents the infection of a medical ointment with mold spores. Without this application they found it almost impossible to produce a satisfactory product for Army and Navy use in the tropics.

The immediate educational and promotional job to be done compares in size and opportunity with that preceding acceptance of milk Pasturization and water sterilization. The one difference is that air disinfection is a continuous process—the air being continually re-infected. In the postwar future, air disinfection seems likely to stimulate a record demand for public health germicidal lamps and a consequent new and broadened market opportunity for contractors and distributors.

Motor shop specialists of Rockford, Illinois are (L to R) M. E. Fenelon, Supt. of Large Motor Dept.; E. K. Bacon, manager; and Theodore Crowell, Supt. of Small Motor Dept. —all with the Rockford Power and Machinery Division of Midstates Industrial Corporation. Mr. Bacon reports unusual success with returned service men in his small motor department—seven of the nine men there being ex-GI's.

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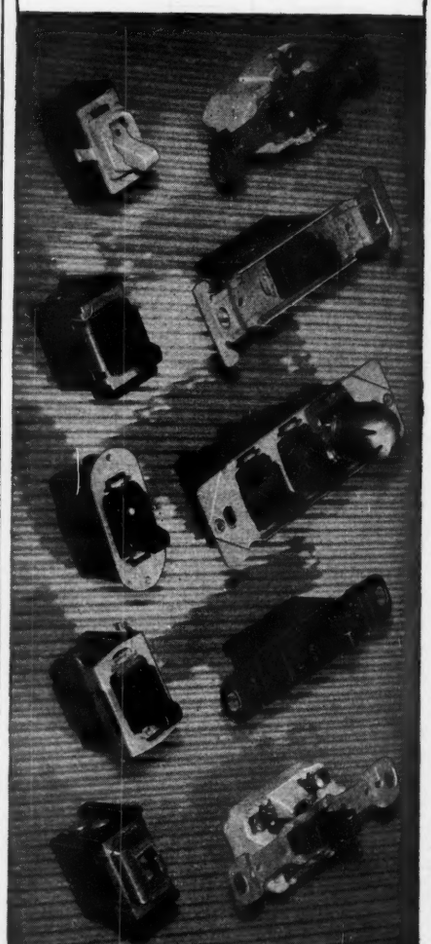

● If you need switches — for residential or industrial use or for special appliance applications — consult your P&S Catalog. All precision-made — all backed by over 50 years' experience in the manufacture of wiring devices. Send for your copy of our No. 42 Catalog.

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HOW MUCH WILL IT COST (from page 87)

step will be to get back to the base labor cost. From the estimator's "spot check" of the units, he can get his approximate labor ratio. With that he finds what portion of the final unit is represented by the base labor.

Assume a "40–60" ratio. On the basis of 1.00 as a base cost, the final selling unit would be:

(Material + 10%) + (Labor + 52%)
= (0.40 + 0.04) + (0.60 + 0.312)
= 0.44 + 0.912 = 1.352
Use 1.35

$$\text{Then: } \frac{\text{Labor}}{\text{Selling Unit}} = \frac{0.60}{1.35} = 0.4444$$

Base Labor = 44.44 percent of the Selling Unit.

Since the base labor represents 44.44 percent of the selling unit, the multiplier 0.4444 can be used to establish the base labor for any selling unit on a "40–60" ratio job. By the same process we find that the *base material price is approximately 30 percent of the selling unit.*

The unit for a 500 watt outlet with 12-ft. spacing on a flat concrete ceiling (K.O. box) is $10.00. The base costs would be:

Material (30% of $10.00) = $3.00
Labor (44.44% of $10.00) = $4.44

When the base labor costs have been altered to fit the local scale and labor conditions, the estimator can proceed with his usual method of mark-up.

After adjusting a certain number of units, the estimator can establish multipliers for application to the remainder of the prices. Results will be close enough for preliminary estimating purposes. Why be fussy about two or three percent error in adjustments for preliminary estimating when, in ordinary estimating, we know that lack of knowledge of job conditions may throw us off as much as five percent or more. Besides, at best, we find it quite a struggle to grab everything that affects labor cost and throw it into an estimate.

These figures are the *contractor's selling price* (including all mark-ups) and *represent the "cost to the owner."*

We used to think that an electrical estimator's simplest task was to tell an owner approximately "how much per outlet" his wiring would cost. From the foregoing it is evident that, if such approximations are intelligently and accurately determined, even this seemingly simple branch of electrical estimating offers numerous problems. *There just isn't any easy method of developing accurate estimating units.*

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● *ALL* CRESCENT Service Cable is insulated with a Type RH, super-aging, heat resisting rubber compound of the best grade obtainable that gives *35 to 44% greater current carrying capacity* than ordinary code grade insulated service cable.*

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● With CRESCENT SERVICE CABLE you get maximum load capacity, long life and value. Made in Type SE, Style U, as shown; style A with a galvanized steel armor tape over the bare neutral conductor, and in type SD, Drop Cable. Sizes #12 to #2 AWG in two and three conductors.

* Based on 1940 N. E. Code

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WIRING SYSTEMS
WIRES AND CABLES

IN THE NEWS

INTERNATIONAL LIGHTING EXPOSITION COMPLETES PROGRAM OUTLINE

The NEMA sponsored International Lighting Exposition and Convention, to be staged in Chicago's Stevens Hotel from April 26th to 30th, has completed details for the five day program of conferences, forums, exhibits and features. Over 60 exhibitors will participate in a comprehensive presentation of available lamps, lighting equipment, wiring and accessories. The application, utilization and sales methods for lighting equipment will be intensively discussed in the forums planned to promote the most efficient uses for light and lighting techniques. Displays are directed to further safety, production, comfort, convenience and utilization.

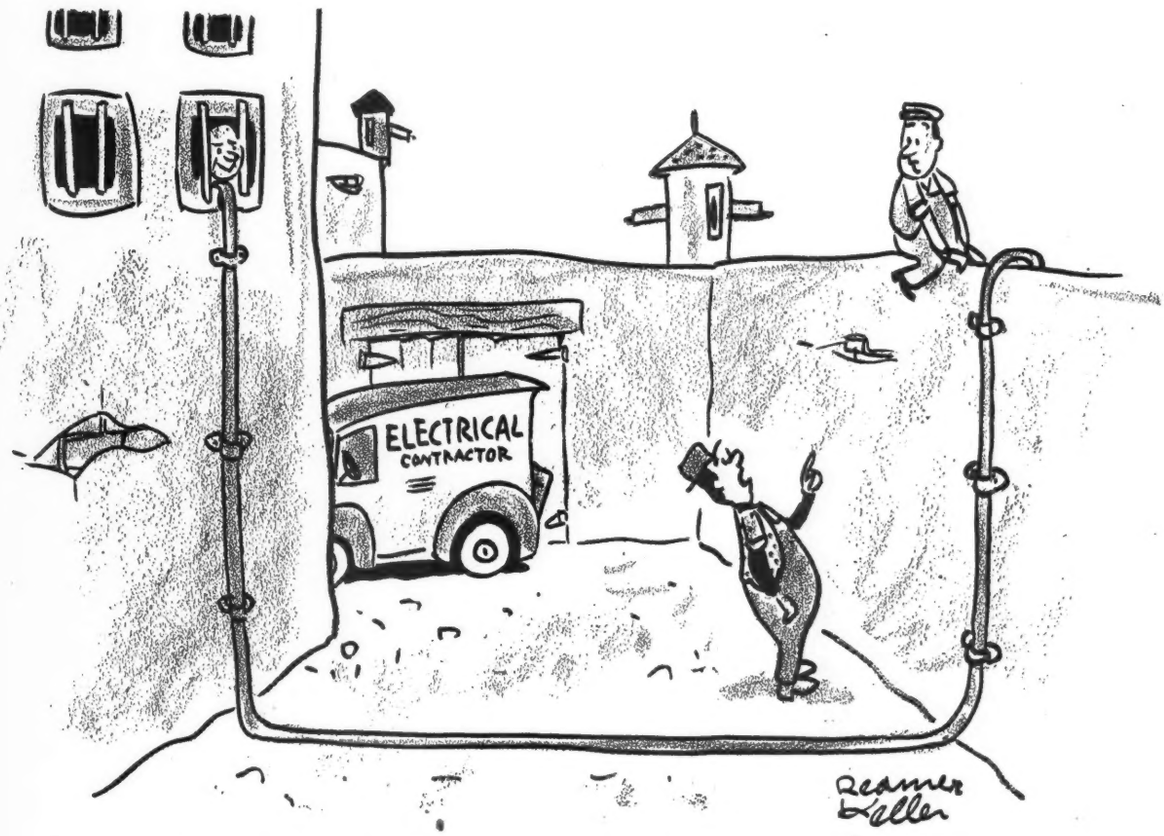
Members of the National Electrical Wholesalers Association are invited to attend an Exposition preview Thursday afternoon, April 25th. The Exposition doors will officially open to the public daily from 12 noon to 6 P. M. The program includes four morning conference sessions which will present "New Trends and Methods" April 26th, "Sales Forum for Electrical Contractors" on the 27th, "Industrial Conference on Service and Sales Training" the 29th and "Lighting Application Forum" the 30th.

Tickets to the conferences are available to electrical contractors and wholesalers, utility personnel, illumination engineers, architects and all educational, industrial and commercial men concerned with the field. Invitation tickets may be obtained from exhibitors, NEWA, the Exposition office at 111 West Jackson Blvd., Chicago, or local electrical leagues and associations.

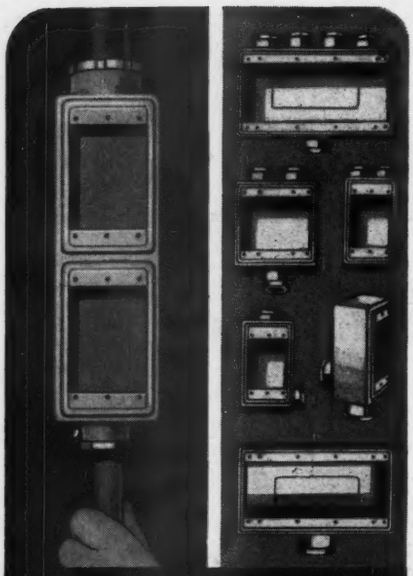
FHA SPONSORS LOW COST HOUSING

Construction of moderately priced housing units to be offered primarily to returning servicemen is receiving priority attention from the Federal Housing Administration. Application forms for priorities governing critically short building materials are available at the 71 FHA field offices. A cost ceiling of $10,000 has been set to cover both the construction and property of a private home while a rent ceiling of $80 a month has been set for new multiple dwellings.

FHA Commissioner Raymond M. Foley states that, "It is hoped that between 400,000 and 500,000 units can be placed under construction this year", but reminds builders that priorities will be granted only to applicants complying with all regulations. The FHA field offices must be satisfied that the proposed



"Never mind how the inmates tell you to rewire this place! You follow the blueprints!"



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Post-session confab between (L to R) Marshall Havenhill, Kansas City Power and Light Co.; A. F. Wakefield, I.E.S. president; and David H. Mason, Mason & Basedow, at recent Regional I.E.S. conference in Davenport, Iowa.

sale price or rent is reasonably related to the proposed accommodation. Applicants must be ready to start construction within 90 days and must have effective control of the land, the necessary finances, local building permits and utility services. Applicants must agree to make the housing available only to veterans during the period of construction and for 30 days thereafter and, in the sales agreement, the veteran is also pledged to a 30 day waiting period in the case of a re-sale. Conversion of existing structures may be included in these regulations where it is shown that increased dwelling units will result.

The materials to which priorities will apply include common and face brick, clay sewer pipe, structural tile, gypsum board and lath, cast iron soil pipe and fittings, cast iron radiation, bathtubs, lumber and millwork. This list may be amended depending on future supply and demand.

FIVE STATES TO GET 11,322 MILES OF REA LINE

Recent estimates of REA Administrator Claude R. Wickard indicate that 3,371,189 of the nation's farms are still without central station electric service. Allotments for five North Central States (Minnesota, North and South Dakota, Iowa and Wisconsin) will build approximately 11,322 miles of rural high lines to serve farms in those areas.

Distribution of allotted funds are as follows:

State	Farms without Central Station Electric Service July 1, 1945 Number	%	Allocation for Loans Fiscal Year ending on June 30, 1946
Iowa	84,718	39.7	$2,513,001.00
Minnesota	104,851	53.1	3,110,208.00
North Dakota	67,712	91.5	2,008,550.00
South Dakota	64,154	88.5	1,903,008.00
Wisconsin	62,285	33.4	1,847,568.00
Total 5 North Central States allotted to October 12, 1945 during fiscal year ending June 30, 1946			$11,382,335.00

Assuming average cost of $1,000 per mile, this amount equals 11,382 miles.
Assuming initial density 2 farms per mile, this amount will serve 22,644 farms.

Based on the increased acceptance of adequate farm wiring and the present economic status of farmers in these areas, conservative estimates predict an average farm wiring job will cost about $250.00—or a total of $5,661,000 of farm wiring. At an average of 80 man-hours per farm, this means 1,811,520 man-hours of labor or enough to provide full employment for 750 electricians for a full year.

The foregoing estimates are for farms to be connected to REA lines only. To this must be added a considerable number of farms that will be served by commercial and municipal utilities in these states. Then a fairly complete picture of the rural wiring potential in these states can be visualized.

NECA LEADERS PICKED FOR NEB.-W. IOWA AREA

The recently organized Nebraska—Western Iowa chapter of the National Electrical Contractors Association has elected S. C. Dodson, Omaha, as president; A. C. Sykes, Omaha, as vice president and M. W. Flynn, Council Bluffs, Ia. as treasurer. All of these officers head electric companies bearing their individual names. The secretary-manager is A. B. Parks. Directors of the group are C. E. Wallin and W. H. Guthrie of Omaha and A. B. Whitmer of Lincoln, Neb. H. Binder, Omaha, is alternate.

REA DIVISION HEAD APPOINTED

Appointment of Frank A. Dawes of Hollister, Mo., as chief of the Cooperatives' Operations Division of the Rural Electrification Administration has been announced by the Department of Agriculture. Mr. Dawes succeeds T. J. Robertson of Arkansas who resigned in December to enter private business. Since 1941, Mr. Dawes has been manager of the White River Valley Electric Cooperative, Inc. He was active in organizing the cooperative and served as its first president. While manager of the cooperative, Mr. Dawes developed one of REA's first so-called "self-help" projects, which enabled farmers to pay

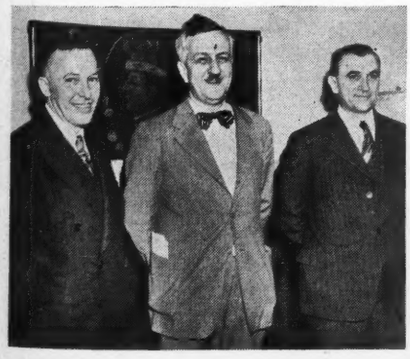
for wiring their homes and farms by working on right-a-way clearance and construction for rural distribution lines. Administrator Claude R. Wickard states that Mr. Dawes will direct the work of REA personnel dealing with 865 REA-financed rural electric cooperatives, on such matters as operating budgets, rate schedules, purchase of wholesale power and the maintenance of continuity and quality of electric service to rural customers.

H. C. CALAHAN HEADS N. Y. ELECTRICAL AND GAS ASSN.

H. C. Calahan, general representative, General Electric Supply Corp., was elected president of the Electrical and Gas Association of New York Inc. at its annual January meeting. Other officers elected were: first vice president, T. H. Joseph, president, E-J Electric Installation Co.; second vice president, James Boyd, Eastern district manager, Westinghouse Electric Corp.; third vice president, J. W. Walter, president, John W. Walker, Inc.; fourth vice president, J. M. Winer, president, Dynamic Electronics-New York Inc.; treasurer, James A. Sackett, sales manager, Kings County Lighting Co.; secretary, C. A. Norton, sales manager, Pierce Laboratory Inc.; and assistant secretary, H. A. Olson, manager, Atlantic sales district lamp dept., General Electric Co.

EDUCATIONAL AIDS RELEASED BY A/W BUREAU

With a wide variety of promotional and educational material planned for distribution shortly the National Ade-



New officers of the Cook County Electrical Contractors Association, Chicago, for 1946 are: (L to R) President — Emil DeHaan, Service Electric Shop; vice-president — George W. Reinke, George W. Reinke Electric Co.; treasurer — Joseph Kunst, Principle Electric Co. The new secretary Theodore Osberg, Riverside Electric Company, is not in the photo.

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● Among the first to manufacture fluorescent lamp ballasts for the lighting industry, Chicago Transformer has an outstanding record for producing units whose ruggedness and quality have been time-tried and field-tested.

Complete manufacturing facilities and engineering know-how, developed during 18 years of producing specially-designed transformers for the electronic field, have been applied throughout the design and manufacture of C.T. ballasts.

Look for the Chicago Transformer Trademark — your assurance of long-lived, trouble-free fluorescent installations.

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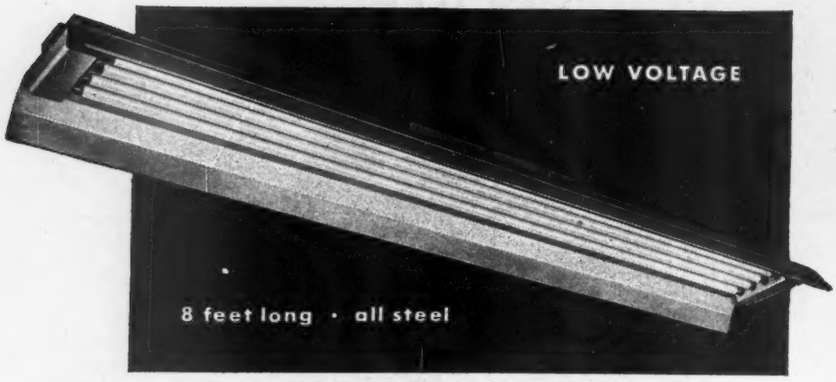

Here is the new Colovolt industrial fixture, one of a complete line of industrial and commercial "packaged" units. Equipped with the standard 93" Colovolt 10,000 hour lamp, Colovolt fixtures may be used singly or in continuous line lighting in multiples of 8 feet. Instantaneous starting, no flickering, guaranteed for 1 year except for failure due to breakage are extra advantages of the Colovolt Cold Cathode low voltage fluorescent lamp. The long life expectancy of Colovolt lamps may be realized even when constantly turned on and off, and *pre-scheduled re-lamping, with no loss of production or time, is now possible with Colovolt installations.*

*Trade mark registered U. S. Pat. Off.

Contact your electrical wholesaler or jobber, or write us for full details and prices.

GENERAL LUMINESCENT CORPORATION
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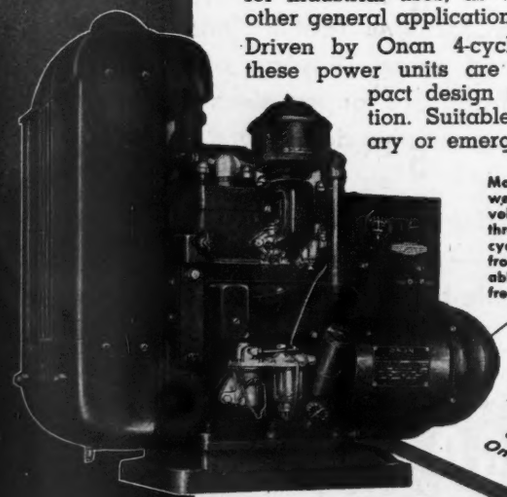
Electricity

ELECTRIC PLANTS Onan

FOR ANY JOB—ANYWHERE

ONAN ELECTRIC GENERATING PLANTS supply reliable, economical electric service for industrial uses, as well as for scores of other general applications.

Driven by Onan 4-cycle gasoline engines, these power units are of single-unit, compact design and sturdy construction. Suitable for mobile, stationary or emergency service.



Models range from 350 to 35,000 watts, A. C. types from 115 to 660 volts, 50, 60, 180 cycles, single or three-phase and 400, 500 and 800 cycles, single phase. D. C. types from 6 to 4000 volts. Also available in dual voltage and special frequency types.

Write For Folder 690-A describing complete Onan Line

Model shown is from W2C series: 2000 to 3500 watts; powered by Onan two-cylinder, water-cooled engine.

D. W. ONAN & SONS
2112 Royalston Ave. Minneapolis 5, Minn.

Similar names and activities are the lot of (L to R) R. G. Morison, president, Essex Electrical League, Newark, N. J.; John A. Morrison, managing director, Philadelphia Electric Association; and Wm. G. Morrison, assistant secretary of the Essex group in Newark.

quate Wiring Bureau will launch its first aggressive program since the beginning of the war.

The program will include practical aids to help electrical leagues and utilities demonstrate the advantages of adequate wiring to consumers, builders, architects, contractors, home economists and industry employees.

In a broadside mailed recently to 2,400 key people connected with leagues and utilities who are making constructive contributions to the adequate wiring movement, the National Adequate Wiring Bureau announced details of the 1946 program, and urged all groups to make plans *now* for aggressive wiring promotion in the coming year.

Divided into two main groups—aimed at the new home and home modernization markets—the material will specifically include:

Builder Program—a builder presentation book to be used by electrical industry groups in selling the builder on the advantages of installing adequate wiring, consumer folders and newspaper ads to be used by the builder in selling certified adequately wired homes.

Wiring Modernization Program—a direct mail campaign for direct consumer promotion or for a cooperative tie-in with financing agencies—composed of material aimed at those who will redecorate, those who will streamline their kitchens and laundries, and those who will remodel and make general repairs.

Teaching Aids for High School Home Economics Instructors—teaching outlines and student project sheets to be used by high school teachers in discussing the need for adequate wiring.

Adequate Wiring Training Material

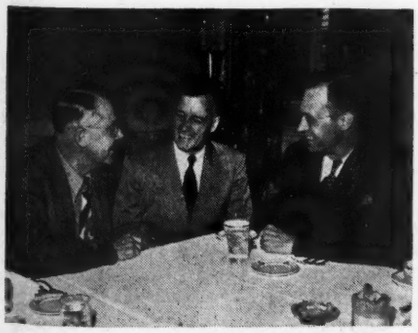
Pre-session huddle at recent IAEL conference in Chicago with (L to R) Paul J. McMillan, Chattanooga; Nels Christopherson, Milwaukee; and B. H. Barg, Milwaukee contractor discussing League adequate wiring promotion.

for Electrical Industry Employees—includes a training program outline, demonstration chart, presentation, lecture, and house plans for wiring layout practice.

REA ON THRESHOLD OF SURGING ACTIVITY

An all-time high for wholesale energy purchased during a single year by Rural Electrification Administration borrowers and a record low purchase rate has been announced by the U. S. Department of Agriculture.

During the 1945 fiscal year over 2¼ billion kwh. of electrical energy were distributed to 1,287,000 consumers with wholesale costs dropping to 8.2 mils per kwh. Purchases from publicly-owned



R. D. Horning, Electrical Contractors Association, Seattle, Carl Edstrom, E. N. E. Appliance Co., Portland, and D. B. Leonard, Pacific Power & Light Co., Yakima, confer at lunch during a meeting of the Executive Committee, Northwest Electric Light & Power Ass'n., in Seattle.

AUTH

is 5 ways better—

FOR INDUSTRIAL SIGNALING SYSTEMS

Underdome bell is only one of the many popular Auth types

With the Selecto-dial intercom phone, you just set the dial, push the button and talk. Many other Auth phones available

Annunciators for all signaling and supervisory alarm purposes —both drop and lamp type

1 ELECTRICAL ENDURANCE: Auth bells, buzzers, annunciators, intercom phones, and other signaling and communication devices are as electrically age-proof as it is possible to make them. Over 50 years of experience have been put into the selection and design of quality insulation, contacts, terminals and other vital details.

2 MECHANICAL "GUTS": There's severe mechanical action in most signaling devices, and Auth devices are built to take it. Auth simpler designs eliminate unnecessary mechanisms. Springs have long life. Fatigue and corrosion-resistant materials are used where needed. Housings are strong—withstand severe abuse.

3 BEAUTY OF TONE AND APPEARANCE: An important factor in systems that are in constant use.

4 EASY TO INSTALL: Designed-in features of Auth devices provide mounting screws where you can get at them—easy-to-remove covers—plenty of room around terminals.

5 ENGINEERING SERVICE: Experienced Auth engineers are ready to help you in two ways: by suggesting equipment and layouts for your signaling systems; and by helping in the development of any special device that you may need. Talk it over wtih our representative near you, or with your wholesaler.

1-W

AUTH ELECTRICAL SPECIALTY COMPANY, INC.
422 EAST 53rd STREET NEW YORK 22, N. Y.
Offices in AUTH Principal Cities
SINCE 1892

Bend Conduit Cold-

Here's How

Conduit can be bent

40°

to any desired angle

60°

without moving pipe

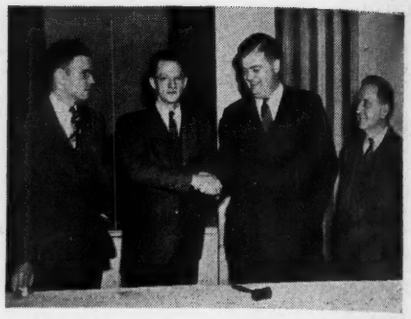
90°

in one operation

with Tal's Prestal Pipe Bender

Installation work goes faster, easier, and at a lower cost when you have a Tal's Prestal Bender on the job. This efficient, light, portable machine handles all pipe and conduit up to 3". Makes perfect bends, up to 90°, cold, in one single operation. No need to waste labor by replacing the pipe three to six times to make a bend. Does a good workmanlike job — smooth, uniform bends without kinks or wrinkles. Simple and easy to operate. Thousands are in successful use everywhere. Write for data bulletin.

Tal's Prestal Bender, Inc.
Dept EC-2, Milwaukee 2, Wisconsin



Chosen to guide the activities of the Electric Motor and Service Association, Chicago (Central District Chapter, NISA) are: (L to R) Vice-president—J. G. Lessel, Central Electric Motor and Repair Co.; president—Robert C. Kaska, Chicago Electric Co., shaking hands with retiring-president Paul Martin; and treasurer—James J. Smat, Queen City Electric Co. New secretary H. P. Lehman, Lehman Electric Co., is not in the photo.

suppliers totaled 55.4 percent of the total at an average unit cost of 6.6 mils while privately-owned suppliers furnished the residual 44.6 percent at an average rate of 10.1 mils per kwh.

Completing a decade of service since its establishment, the REA announces that 926 borrowers have lines either in operation or in the design stage for carrying electricity to 1,329,000 farms and rural homes. Nearly 565 million dollars already have been borrowed for rural electrification projects and an additional 200 million will be allocated this coming June. Within the next five years it is contemplated that more than 3,566,000 rural consumers now without electricity will be serviced, involving an investment of over a billion dollars. Interest in these projects has increased tremendously since the removal of wartime restrictions on line construction,

BELL SPLIT-SECOND VOICE PAGING PLANT-WIDE COVERAGE

- VOCAL PAGING
- ANNOUNCEMENTS
- MUSICAL PROGRAMS
- TIME SIGNALS
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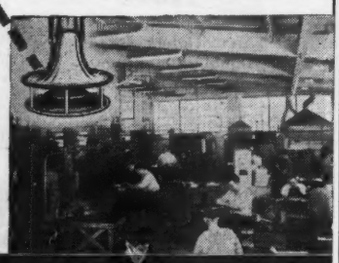
- MANY OTHER USES

First to be specially designed for industrial needs, BELL Voice-Paging Equipment gives you *all* the above advantages plus many outstanding features. Standard, matching, heavy duty, tamperproof units combine readily to meet any requirement and permit easy rearrangement or expansion as needs change or grow. Write today for complete information on BELL Voice-Paging Equipment!



ARMY E NAVY

BELL SOUND SYSTEMS

BELL SOUND SYSTEMS, INC.
1196 Essex Ave. Columbus 3, Ohio
Export Office: 4900 Euclid Ave., Cleveland 3, Ohio

Bob Melville (center), inspector-at-large for the North Dakota State Board of Electricians discusses grounding of farmstead wiring with Albert Bartsch (left), Al's Electric Service, Rugby, N. D.; and Paul Kritzberger, Kritzberger Electric, Hillsboro, North Dakota.

the establishment of a new low interest rate of 2 percent and the lengthening of the amortization period to 35 years.

An additional service of the administration is emphasized by the fact that during the past year about $750,000 worth of property, not available through normal channels, was purchased by REA borrowers through the special Surplus Property Office set up to assist rural borrowers in obtaining war materials.

Wm. McGuineas, president, Electrical Contractors Association of City of Chicago (left) and R. A. Stewart, G. E. Supply Corp., discuss the electrical construction materials supply situation in the Chicago area.

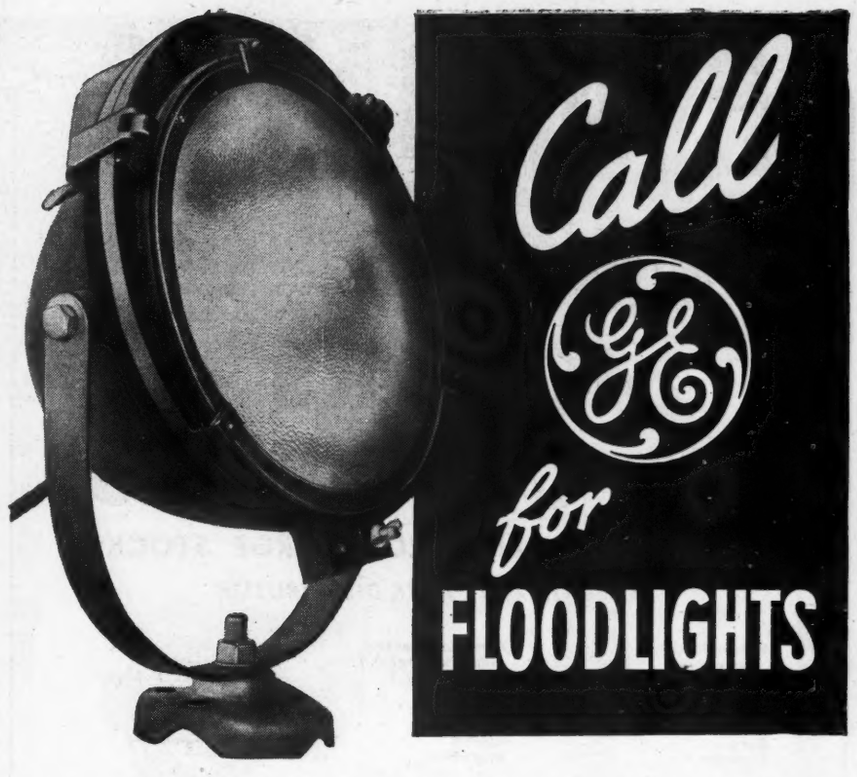
SAN JOAQUIN CONTRACTORS ELECT LEADERS

The Electrical Contractors and Dealers Association of San Joaquin County, Calif., Inc., held their annual meeting and banquet in December.

James E. McCarty of the Bright Spot Electric Co., was elected president. Other officers elected were Fred T. Schooley, vice-president, and Wm. V. Kelly, secretary-treasurer. Retiring president Grover A. Grider and Rolly Goold were elected to the board of directors to serve with the officers elected. E. H. Grogan will continue as executive secretary of the association, a position which he has held for the past nine years.

REA RETURNS TO CAPITAL

The Rural Electrification Administration is again located in Washington after a 44 month wartime stay in St. Louis and, for the first time in its history, will be housed in buildings of the Agricultural Department. In March of 1942



...and get these important advantages

- ★ Proper types and sizes for all applications
- ★ High-efficiency, the result of scientific design
- ★ Long life and low maintenance expense, obtained through sturdy construction
- ★ Expert assistance with application problems, backed up by 30 years' experience
- ★ Convenient sales and service facilities

WANT THESE HANDY DESCRIPTIVE LEAFLETS FOR YOUR PROPOSALS?

FLOODLIGHT	PUBLICATION
Heavy-duty, steel casing	
200 or 250 watts, Type L-29	GEA-4303
300 or 500 watts, Type L-30	GEA-4304
750 or 1000 watts, Type L-31	GEA-4305
Heavy-duty, cast aluminum	
200 or 250 watts, Type L-38	GEA-4325
General purpose, sheet aluminum	
300 or 500 watts, Type L-49	GEA-4311
750 or 1000 watts, Type L-43	GEA-4310
Sports and area, sheet aluminum	
750 to 1500 watts, Type L-68	GEA-4333
Area, open porcelain enamel	
300 to 1500 watts (Type L-45)	GEA-4433
(Type L-46)	GEA-4432
Handy, sheet aluminum	
200 watts, Type L-66	GEA-4346
Underwater	
100/250/400 watts (Type L-33)	GEA-4438
500/1000/1500 watts (Type L-41)	GEA-4439

Order individually by number, or in sets, from the G-E Apparatus Sales Office or Agent that serves you. Or write General Electric Company, Schenectady 5, N. Y.

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READING ELECTRIC COMPANY, INC.

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BADGER
Synchronous Automatic **TIME SWITCHES**

for
ACCURATE TIMING
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ECONOMICAL OPERATION
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YEARS OF GOOD SERVICE
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● *Prompt delivery without priority*

Type	Poles	Switch Capacity	Case
Mi (Synchronous)	1	50 A. at 125 V.	16 Ga. Steel
M. 2 "	2	50 A. at 125/250 V.	16 Ga. Steel
RM "	1	50 A. at 125 V.	Cast Iron
RM5 "	2	50 A. at 125/250 V.	Cast Iron

RELIANCE AUTOMATIC LIGHTING CO. **RACINE WISCONSIN**

Rounding the North Dakota Electrical Contractors Association into a well organized, highly respected trade group are its president Clyde Kieley (left), Grafton; and secretary-treasurer George C. Hilstad of Mayville, N. D.

the REA left the national capital to make room for other rapidly expanding agencies which could not function away from the city. Although the organization is rendering a more comprehensive service today than at any time since its inception, the personnel has been streamlined from the St. Louis total of 940 to the present complement of 650.

HOUSING GETS TOP CONTRACTOR PRIORITY

Members of the Illinois Chapter, National Electrical Contractors Association, at their December meeting in

REA representatives at winter meeting of the North Dakota Electrical Contractors Association, Fargo, N. D., (L to R) R. L. Jacobson, R.S.R. Electric Co-op., Milnor, N. D.; Joe Finell, Cheyenne Valley Electric Co-op., Portland, N. D.; and C. H. Carl, application and load director in charge of Region 6 (N. D. and S. D.), St. Louis, Missouri.

Peoria, gave the green light to postwar housing construction insofar as electrical work is concerned. By way of resolution this chapter went on record ". . . to place home construction on the top of the priority list and to expend every effort to divert the necessary materials into this channel."

Reports presented at the meeting indicate that the required manpower is available throughout the state and no difficulty should be experienced in this respect. Although material shortages are apparent, the belief of the contractors was that sufficient materials will be available for these homes. Should the supply be threatened, however, the contractors agreed to curtail all other work to assist the house wiring crisis. Governor Green's appeal to push house construction will be met with full cooperation of the Association.

Farm homestead wiring is a family affair for the P & M Electric of Milner, N. D. Pondering over their backlog of wiring are the owners Mr. and Mrs. Paul McAdams. Mrs. McAdams does all the estimating and sells the farmer's wife on all the conveniences of electrical appliances while helping her plan her kitchen, laundry and other house wiring. Meanwhile, Mr. McAdams takes the farmer by the arm and plans his outbuilding service and wiring, selling him the advantages of electric pumps, hay drying systems, milking machines, feed grinding and other electric farm production aids. Its a winning combination.

Discussions revealed that there has been no case of OPA ceiling violations within the jurisdiction of the chapter and this line will be held with the members cooperating with and amplifying the OPA program to help fight inflation.

A slate of officers were presented for nomination and the election will take place at the next state meeting of the group to be held in February.

IMPORTANCE OF SOUND WIRING IS STRESSED

New Orleans electrical contractors are conducting a better-wiring promotional campaign by educating the buying

FULLMAN Latrobe PRODUCTS

FLOOR BOXES · WIRING SPECIALTIES

FULLMAN MANUFACTURING CO. QUALITY LATROBE SUPREMACY LATROBE, PA.

Latrobe Products Will Help Get Things Done

The time factor is cut to a minimum when Latrobe specialties are used. They are easily and quickly installed, absolutely trustworthy and may be depended upon for long service.

NO. 470 "LATROBE" PIPE OR CONDUIT HANGER

Convenient and safe for hanging pipe or conduit ½", ¾" and 1" to steel beams up to ⅜" thick. Holds with firm grip.

NO. 208 NOZZLE WITH NO. 200 COVER PLATE

Here is a superior ten amp. 250 volt receptacle in brass housing, ½ in. brass extension.

"BULL DOG" INSULATOR SUPPORT ATTACHED TO "B & D" CLEAT

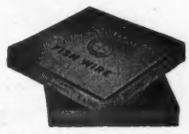
The cleat attachment consists of cross bar with necessary bolts and screws. Insulator supports are suitable for attaching porcelain or glass insulators to exposed steel framework.

NO. 480 "BULL DOG" ARMORED CABLE SUPPORT

Nothing more convenient for installing Armored Cable in factories or other buildings of steel construction. Permits cable to run at any angle.

NO. 130 FLOOR BOX WITH NO. 207 BELL NOZZLE

Tapered unit receptacle fits tapered opening in adjusting ring.



KEYSTONE FISH WIRE

Made of the finest grade of flat steel wire. Ten sizes in coils from 100 ft. up.

FULLMAN MANUFACTURING CO.
LATROBE . . . PENNSYLVANIA

All you need to hang Chain Suspension Fixtures is a screw driver plus a

HYDEE HANGER*

Just connect wires, screw to outlet box and the job's done—in a few minutes!

Self-grounding—2-wire cord and plug may be used. Fits standard 4" or 3¼" outlet box or plaster ring. Complete with receptacle, two 5-foot chains, "S" hooks and cord clips. Nothing else to buy. **$1.50** Each List

Day-Brite Lighting, Inc., 5401 Bulwer Ave., St. Louis 7, Mo. Nationally distributed through leading electrical supply houses.

*Patent No. D-141024. Others pending. Underwriters approved.

IT'S EASY TO SEE WHEN IT'S

DAY-BRITE *Lighting*

NEW PORTABLE METAL-CUTTING SAW

- OFF-ON SWITCH
- BLADE EASILY REPLACED
- HARDENED STEEL JAWS
- HIGH SPEED STEEL SAW
- GEARED POWER UNIT

Designed for Electrical, Plumbing and Refrigeration Contractors

The MACHINE CRAFT PORTABLE METAL-CUTTING SAW is a perfect all-round tool for cutting off Pipe, Conduit and solid bars of Ferrous or Non-Ferrous metals. Will cut FLUSH AND SQUARE to any wall or surface. May be employed as a bench tool if desired. WEIGHS only 14 pounds.

The Standard model MACHINE CRAFT SAW has a cutting range of ⅛" to 1" diam. round or irregular pipes and bars.

Priced Complete with Extra Blade $159.50

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PHONE ADAMS 4306

Highlights of the new 1946 N. E. Code is conversational subject of Glenn Rowell (left), electrical engineer, Fire Underwriters Inspection Bureau, Minneapolis, Minn., and Ben J. Reger, electrical contractor of Fargo, North Dakota.

public as to the importance of taking a common sense, long range view of the domestic modernization problem. Home owners wishing to modernize or construct additions are being reminded that wiring buried in walls, ceilings and floors should be adequate to carry all ing should be installed prior to any contemplated future loads. Modern wircontemplated redecorating, construction or addition of new equipment in the laundry, kitchen, heating and utility rooms. Postponing wiring for future attention may result in overloading circuits, costly fires and repairs to newly completed work.

S. V. Evans (left) reflects on the age of this motor as his father, T. T. Evans, inspects it upon its arrival at their shop. This father and son partnership forms the Evans Motor Repair Shop, Utica, New York. It was established in the fall of 1944 to serve the hard pressed war plants in the Utica area, and is now busy with motor repair work involved in reconversion.

Ed Harris (left), Triangle Conduit and Cable Co., and J. E. McCawley, Graybar Electric Co., both of Minneapolis, enjoy a post-meeting session at North Dakota Electrical Contractors Association conference in Fargo.

"CREDIT SOURCES FOR SMALL BUSINESS"

The U. S. Department of Commerce has released a booklet under the above title that may be obtained by banks, other financial institutions or interested individuals from either the department field offices or from the Superintendent of Documents in Washington. How small businesses may obtain capital and credit for sound business ventures is the theme of this bulletin that discusses in detail the types of credit extended by banks, RFC, FHA, companies handling industrial banking, small loans, sales finance, insurance and by other diverse institutions.

The treatise explains character, term, installment and equipment loans as well as loans on accounts receivable and by warehouse inventories. "Mutual frankness is the first basis of good banking",

W. R. Johnson, Veterans Administration, Fargo, N. D., outlines the training requirements of Public Law 16 for handicapped disabled veterans and the GI Bill of Rights before the recent conference of the North Dakota Electrical Contractors Association at Fargo.

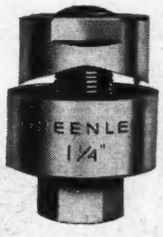
"Our three GREENLEE Hydraulic Benders are great timesavers during these busy days," reports Biggs and Kirchner, Inc., electrical contractors of Washington, D. C.

"They provide labor savings as high as 50% and they operate with practically no maintenance cost whatever."

With a GREENLEE Bender you, too, can work your jobs faster, better. For the GREENLEE is easily carried, set up *and operated by one man.* Makes fast, smooth, accurate bends in pipe up to 4½", rigid and *thin-wall* conduit, tubing, bus-bars. There's no wrinkling, kinks or other damage to conduit this way.

And remember—whatever your bending job — there's a GREENLEE to do it. For facts on the complete GREENLEE line of Hydraulic and Hand Benders and other tools, write today for your free copy of Catalog 33E. Greenlee Tool Co., Division of Greenlee Bros. & Co., 1742 Columbia Avenue, Rockford, Illinois, U.S.A.

REGISTERED TOOLS
GREENLEE
FOR THE CRAFTSMAN



KNOCK-OUT TOOLS Eliminate time spent on drilling and filing to enlarge holes. In 1½ minutes or less you can cut a hole up to 3½" with a GREENLEE Cutter or Punch. Just insert tool in a knock-out or small drilled hole, give a few turns of the drive nut with an ordinary wrench! For clean, round holes in bakelite, hard rubber or any metal up to ⅛" thick.

OTHER GREENLEE TIMESAVING TOOLS FOR ELECTRICAL WORK
Hand Benders • Joist Borers • Cable Pullers • Radio Chassis Punches • Pipe Pushers

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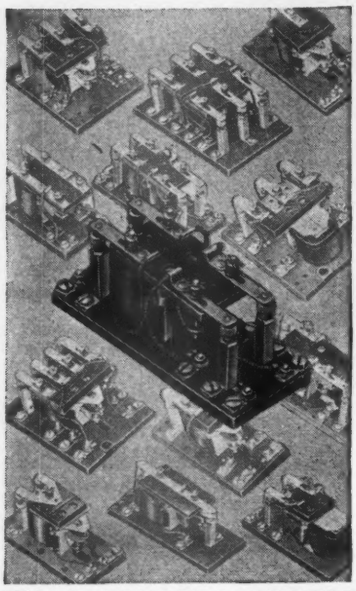

BULLETIN 130 RELAYS

The Bulletin 130 relays offer the user the choice of one to four poles, 6 to 230 volts D. C. and 6 to 440 volts A. C. in single or double throw, normally open or closed, with or without blowout coils and a host of other options. With such flexibility of arrangement, custom requirements can be met without prohibitive cost or undue delay in delivery.

Send for Bulletin No. 130 giving full particulars of this line of Relays. In it you will find relays that exactly meet your requirements.

WARD LEONARD

RELAYS • RESISTORS • RHEOSTATS

Electric control devices since 1892

WARD LEONARD ELECTRIC CO., 28 SOUTH ST., MOUNT VERNON, N. Y.

OFFICES IN PRINCIPAL CITIES

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CLAMPS WITH EVERY SWITCH AND OUTLET BOX

Yes, with every switch and outlet box, CLAMPS so designed as to completely close knockouts, regardless of size or shape of conductor, loom or insulation. For non-metallic wiring job use U.I.CO. Bakelite Boxes and Covers. All knockouts take every, normally used, wire size.

A safe, Practical and Permanent installation.

Prompt deliveries from Jobbers, centralized warehouses and our factory.

Nos. 3050 & 4050

Nos. 3051 & 4051

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No. 5050

Nos. 3057 & 4057

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No. 5051

No. 5053

No. 5055

AVAILABLE THROUGH YOUR JOBBER

No. 6050

UNION INSULATING COMPANY, INC.

P. O. BOX 351 PARKERSBURG, W. VA.

No. 7050

North Dakota electrical contractors Dewey Rasche (left), Farm & Home Electric, Bottineau; and A. O. Holmes, Holmes Wind Electric, Minot, discuss rural demands for wind electric generating plants in the state.

the bulletin advises and suggests that those seeking loans discuss their problems fully with the personnel of reputable institutions. A nominal charge of 15 cents covers printing and mailing.

MARSHALL N. WATERMAN JOINS ETL IN NEW YORK

Marshall N. Waterman, widely known throughout the lighting and electrical industry, joined the staff of Electrical Testing Laboratories, Inc. in January. He will be located in ETL's New York office.

During the war, and until coming to New York, Mr. Waterman did meritorious service for both the electrical industry and the government. In February, 1942, he joined the War Production Board in Washington, D. C. as industrial specialist in the General Industrial Equipment Division. Two months later he took over the duties of Chief of the Lighting and Fixtures Section, Building Materials Division, WPB, and served in this capacity until January, 1943, when he was advanced to the posi-

Estimating and accounting forms displayed and sold by the Minnesota Electrical Council at the recent conference of the North Dakota Electrical Contractors Association were snapped up like hot cakes by the NDECA members.

L. B. Paist (second from right), supt. of lighting department, Northern States Power Company, Minneapolis, demonstrates new 32-watt 1600-lumen Circline fluorescent lamp at North Dakota Electrical Contractors Conference in Fargo.

tion of Assistant Director of the Building Materials Division. He continued to hold this position throughout the war, and until the Civilian Production Administration was formed to take over peacetime reconversion problems on termination of WPB in October, 1945. At that time he became Assistant Director of the Construction Division, and Chief of the Building Materials Branch, a unit within the Construction Division of CPA, which positions he held until coming to New York.

Mr. Waterman is a graduate electrical engineer from the Massachusetts Institute of Technology, class of 1924. Upon graduation, he went with the General Electric Company for one year in their Schenectady, N. Y., plant. He then joined the Central Hudson Gas and Electric Corporation, Poughkeepsie, N. Y., where he did sales engineering work on power and lighting until 1942, when he joined the War Production Board. He served on many committees with the Edison Electric Institute and Illuminating Engineering Society while connected with the Central Hudson Gas and Electric Corporation. He has continued his I.E.S. activities throughout the war, and is now Chairman of the I.E.S. Advisory Policy Committee. During the summer of 1945 he was in Europe as a government representative on the Technical Industrial Intelligence Committee.

Sales engineers R. E. Bellew and C. A. Russ (L to R), Cutler-Hammer, Inc., Minneapolis, discuss farm applications of electric controls with H. Kivley, Kivley Electric, Carrington, North Dakota, at NDECA meeting.

THE REFLECTOR IS THE BACKBONE OF ANY LIGHTING SYSTEM . . .

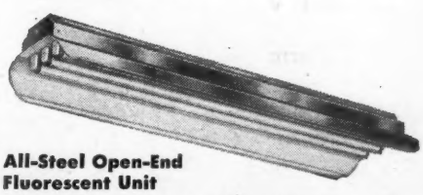
Skilled Lighting

Means Light that is RIGHT

The elimination of eye strain, glare, and shadows is just as important as a high level of illumination. Skilled Lighting, the Wheeler way, puts the right amount of light in the right places to achieve four benefits that have an important bearing on profits: greater manual speed, increased accuracy, less spoiled work, and improved worker morale. Skilled Lighting makes your plant a better place to work.

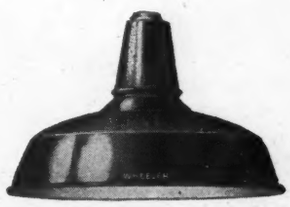
The broad line of Wheeler Reflectors is the backbone of Skilled Lighting. It offers the right fluorescent or incandescent reflector for every area or "spot" in your plant. All are built of heavy gauge metal for long, hard service.

Look in the Wheeler Catalogs for reflectors that show the results of Wheeler's advanced engineering based on 65 years of manufacturing experience. For copies, write to: **Wheeler Reflector Company, 275 Congress St., Boston 10, Mass.** Representatives in principal cities.



All-Steel Open-End Fluorescent Unit

Available for two or three 40-watt, or two 100-watt lamps. Broad wiring channels with accessible, enclosed ballast. Can be mounted from chain or conduit, individually or in continuous runs.



RLM Solid Neck Incandescent Reflector

Maximum lighting efficiency for either indoor or outdoor use. Expertly designed, ruggedly built. 75 to 1500 watts.

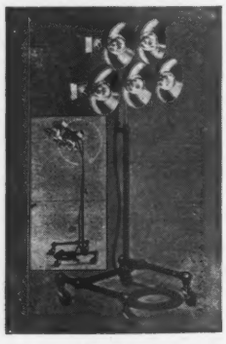
Distributed Exclusively Through Electrical Wholesalers

Wheeler Skilled Lighting REFLECTORS

Made by Specialists in Lighting Equipment Since 1881

FOR A DEPENDABLE INFRA-RED INSTALLATION . . .
NALCO Dritherm INFRA-RED LAMPS

for MODERN DRYING - BAKING - DEHYDRATING



Nalco Dritherm Infra-Red Lamps offer the flexible installation for speedy, clean, low cost, controlled radiant heating energy. Compact and easily installed—in pairs, groups or banks. Lamps available in inside-silvered self-reflector or clear glass types.

PORTABLE UNIT
Compact Nalco 5-lamp portable, adjustable unit.

At your Electrical Wholesaler

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NORTH AMERICAN Electric Lamp Co.
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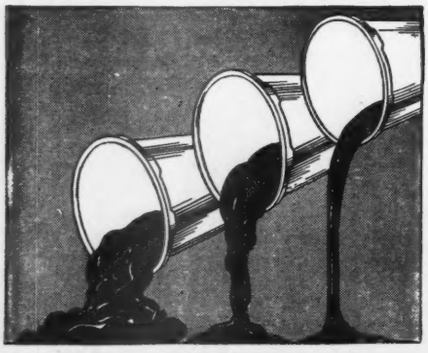
Insulating and Cable-Pulling
COMPOUNDS
of Record-Breaking Performance



Minerallac gives you a complete assortment for every need: dense, viscous and fluid consistencies for high and low voltages in cable-joints, pot-heads, terminal bills, distribution cables, street lighting, telephone work. . . . Insoluble in oil or water, for all temperatures. Clean, safe, economical—outranks all others in quality.

Send for new literature and prices.

MINERALLAC ELECTRIC COMPANY
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MINERALLAC

Byron Hanson, (left), sales manager, Northern States Power Company, Fargo, N. D., tells Rolf Christianson, electrical contractor of Lisbon, N. D., about the electric appliance gravy train.

LOVDAL HEADS MILWAUKEE LEAGUE

R. E. Lovdal, general manager, Westinghouse Electric Supply Co., Milwaukee, was elected president of the Electrical League of Milwaukee at the recent annual meeting of that industry group. J. F. Westly was elected vice-president and T. H. Desmond, treasurer with Nels C. Christopherson re-elected secretary. Chosen to represent industry groups on the Board of Directors were the following: L. P. Shull and E. L. Pittenger, manufacturers; E. J. Peterson, distributors; Gordon Ische, dealers.

Mr. Christopherson revealed that the League, with a new high in membership, is preparing for an active campaign to promote adequate wiring and all-electric kitchens. A committee, headed by Bruno H. Barg, Milwaukee electrical contractor, has reviewed the League's certified wiring program and will propose the adoption of a single standard instead of the three now in existence.

CRIME AND TRAFFIC DEATHS DECREASE WITH STREET LIGHTING

During the year 1944 a total of 24,300 motor vehicle deaths constituted a national tragedy. Of this total 14,200 fatalities occurred during the hours of darkness, according to the National Safety Council. These figures are startling in view of the facts that 1944 was one of our war years when rationing of tires and gasoline curtailed national driving more than 50 percent and traffic analysis proved that only one third of the country's motoring was at night. During both World Wars, statewide traffic fatalities approximated the sum of all our service men and women killed in action in every war theatre.

Visual perception and reflex can be increased greatly by adequate street lighting and a nationwide educational campaign with this objective is being sponsored by the Street and Traffic Safety Lighting Bureau.

Crime is also greater on unlighted thoroughfares and robberies, and other crimes decrease inversely with illumination intensities.

Facts, taken at random from pre-campaign literature, reveal the following:

HARTFORD, CONN. Thirty-two pedestrians were killed at night on ten miles of street in 3½ years before the installation of adequate lighting but in a similar period after re-lighting, only one pedestrian was killed.

SPOKANE, WASH. In four years, with old street lighting, there were 15 pedestrian accidents and five deaths all at night on Spokane's North Division Street. In the 5½ year period since relighting, there have been only three minor pedestrian accidents, two at night and one in daylight with no deaths.

BUFFALO, NEW YORK. As part of its postwar program, the City of

NECA officials at Peoria meeting of the newly organized Illinois Chapter, National Electrical Contractors Association were (L to R) George Seaman, field supervisor, Fort Worth, Texas; Jack G. Krider, secretary-manager and Lyle Foster, president of the Illinois Chapter; and E. L. Santschi, Chicago, midwest field representative. Seaman and Santschi clearly defined the advantages of NECA membership to the 30 members and guests present.

When old friends get together good stories always pop up. Tom Ward (left), Pass & Seymour, Inc., Minneapolis, finds B. K. Skeels, Bismark, N. D. contractor an interested listener.

Buffalo has inaugurated a five-year plan to re-light all streets after a survey proved that night traffic accounts for 74 percent of all fatal accidents.

LOS ANGELES, CALIF. Installation of adequate traffic safety lighting at 20 outlying dangerous intersections reduced, after two years, the number of night auto collisions 72 percent while they increased 26 percent in daylight. Night fatalities declined 92 percent.

BELOIT, WIS. On the first night after turning off the street lights in the residential districts to save money, twenty homes were robbed.

KANSAS CITY, MO. Forecasting increased night accident totals as a result of new car production, Kansas City has authorized the revision and modernization of 750 miles of street lighting equipment.

KCEA ELECTS 1946 OFFICERS

Walter Frazier, Graybar Electric Co., was elected president of the Kansas City

Prominent electrical contractors of Dickinson, N. D. are (L to R) Fred J. Miller, Miller Electric (a director of the North Dakota Electrical Contractors Association); and Chester A. Brown whose Electric Sales and Service Shop is also swamped with work.

ALL STEEL INDUSTRIAL FLUORESCENT FIXTURES

For

ESSENTIAL PLANT LIGHTING

OAMCO All-Steel Heavy Duty Industrials incorporate many desirable features for installations in plants where maximum lighting efficiency and minimum service delays are essential. Reflectors that can be removed for cleaning without disturbing wiring or using tools and starter replacements without lamp removal are but two of the features that speed up servicing.

Reflectors are furnished with either synthetic or porcelain enamel finish and have a reflection factor of more than 80%. Exterior finish is gray.

Enclosed Ballast type are furnished in double 40, triple 40 and double 100 watt sizes and the Exposed ballast type in double 40 only.

Write or wire today for our 1945 catalogs, Fluorescent #106 and Incandescent #104-A.

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MEMBER OF THE R L M STANDARDS INSTITUTE

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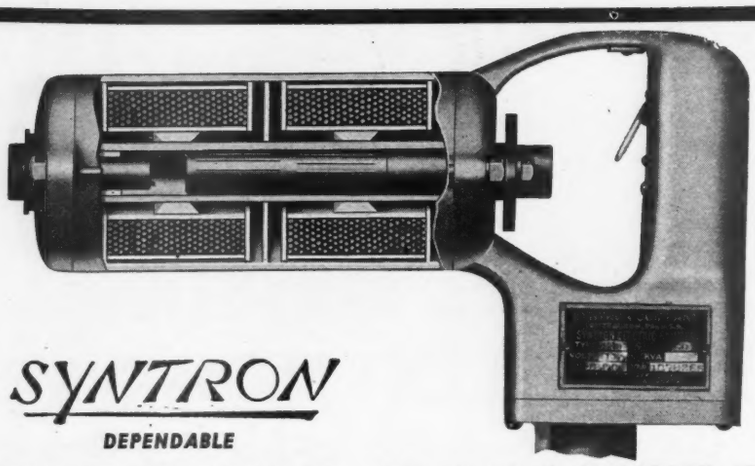

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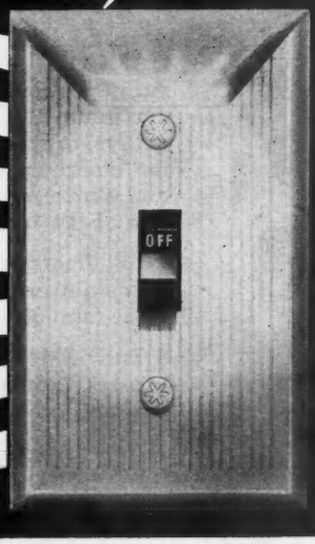


The tiny shielded electric light is *always on* when the room is dark — *always off* when the room lights are on. Ends fumbling for switches. No more smudged walls. Single-gang, two-gang, and multi-gang assemblies available. Operates for less than 2c per year. Works also on 3- and 4-way switches. Guaranteed. For steady profits, sell the *original* LumiNite. List price $1.00. Write for details.

ASSOCIATED PROJECTS CO., 80 E. Long St., Columbus 15, Ohio

Anxiously awaiting opening of the North Dakota Electrical Contractors Association conference at Fargo are (L to R) E. Petersen, Former Elevator Co., Arthur N. D. and Clarence Anderson.

Electric Association at that organization's annual meeting. Divisional vice-presidents chosen at the meeting include: Utilities—C. Myron Lytle, Kansas City Power & Light Co.; manufacturers—A. A. Dahms, Allis-Chalmers Mfg. Co.; wholesalers—J. W. Puckett, General Electric Supply Corp.; contractors—Fred E. Geiss, Fred E. Geiss Electric Co.; appliance dealers— E. J. McGrannahan, Jenkins Music Co.; maintenance, repair and service group—John E. Launder, Independent Electric Machinery Company, Harley C. Davis, K. C. Power & Light Co. was elected secretary-treasurer.

Elected to the Board of Directors were: J. Boring, R. B. Brownlee, G. V. Dameron, J. A. Ekstrom, George Fiske, W. F. Howe, A. C. Jones, J. A. Kramer, C. E. Null, F. A. O'Donnell, H. H. Kuhn and C. G. Roush.

DATES AHEAD

Indiana Chapter — IAEI — Antlers Hotel, Indianapolis, Ind., February 7 and 8.

Rocky Mountain Chapter—IAEI—Rm. 385, City and County Bldg., Denver, Col., February 12.

National Association of Home Builders—Convention and Exposition — Stevens Hotel, Chicago, Ill., February 25–28.

W. A. Martin (left), Martin Electric Co., Cando, N. D. and Chester Oium, Oium Electric Co., Lisbon, N. D., discuss rural line construction at recent meeting of North Dakota Electrical Contractors Association at Fargo.

Minnesota Federation of Engineering Societies—"Northwest Industries First Great Reconversion Show"—Victory Conference at Hotel Radisson. Exposition at Armory, Minneapolis, Minn., February 20-23.

Refrigeration Equipment Manufacturers Association, Hotel Stevens, Chicago, Ill., March 4–7.

North Central Electrical Industries—First Postwar combined electrical industry convention and trade exposition—Radisson Hotel, Minneapolis, Minn., March 10–14.

Rocky Mountain Chapter—IAEI—Rm. 385, City and County Bldg., Denver, Col., March 12.

Chicago Technical Societies Council—Production Show and Conference—Stevens Hotel, Chicago, Ill., March 20 to 22.

Midwest Power Conference—Palmer House, Chicago, Ill., April 3–5.

National Electrical Manufacturers Association — Spring Meeting — Palmer House, Chicago, Ill., April 8.

Rocky Mountain Chapter—IAEI—Rm. 385, City and County Bldg., Denver, Col., April 9.

National Industrial Service Association—National Convention—Tampa, Fla., April 8–10.

American Society of Tool Engineers—Fifth Annual Exposition—Public Auditorium, Cleveland, Ohio, April 8–12.

National Electrical Wholesalers Association—37th Annual Convention — Stevens Hotel, Chicago, Ill., April 21–25.

Society of the Plastics Industry—First National Plastics Exposition—Grand Central Palace, New York, N. Y., April 22-27.

International Lighting Exposition, NEMA—Stevens Hotel, Chicago, Ill., April 25–30.

Chamber of Commerce—Annual Meeting—Atlantic City, N. J., April 29 to May 1.

"Products of Tomorrow Exposition"—Chicago Coliseum, Chicago, Ill., April 27–May 18.

National Modern Homes Exposition—Metropolitan Association of Real Estate Boards—Grand Central Palace, New York, N. Y., May 4-11.

Housewares Show—National Exhibition—Convention Hall, Atlantic City, N. J., May 13–17.

Rocky Mt. Chap.—IAEI—City and County Bldg., Denver, Col., May 14.

National Fire Protection Association—50th Annual Meeting—Hotel Statler, Boston, Mass., June 3 to 6 or 7.

Rocky Mt. Chap.—IAEI—City and County Bldg., Denver, Col., June 11.

National Electrical Manufacturers Association—The Homestead, Hot Springs, Va., June 17–19.

American Institute of Technical Engineers—Summer Convention, Detroit, Mich., June 24 to 28.

Rocky Mt. Chap—IAEI—City and County Bldg., Denver, Col., July 9.

Southern California Construction Industries—Exhibition and Home Show—Pan-Pacific Auditorium, Los Angeles, Cal., July 12–21.

Pacific Coast Convention—AIEE—Seattle, Wash., August 26 to 31.

Rocky Mt. Chap—IAEI—City and County Bldg., Denver Col., August 13.

Rocky Mt. Chap—IAEI—City and County Bldg., Denver Col., September 10.

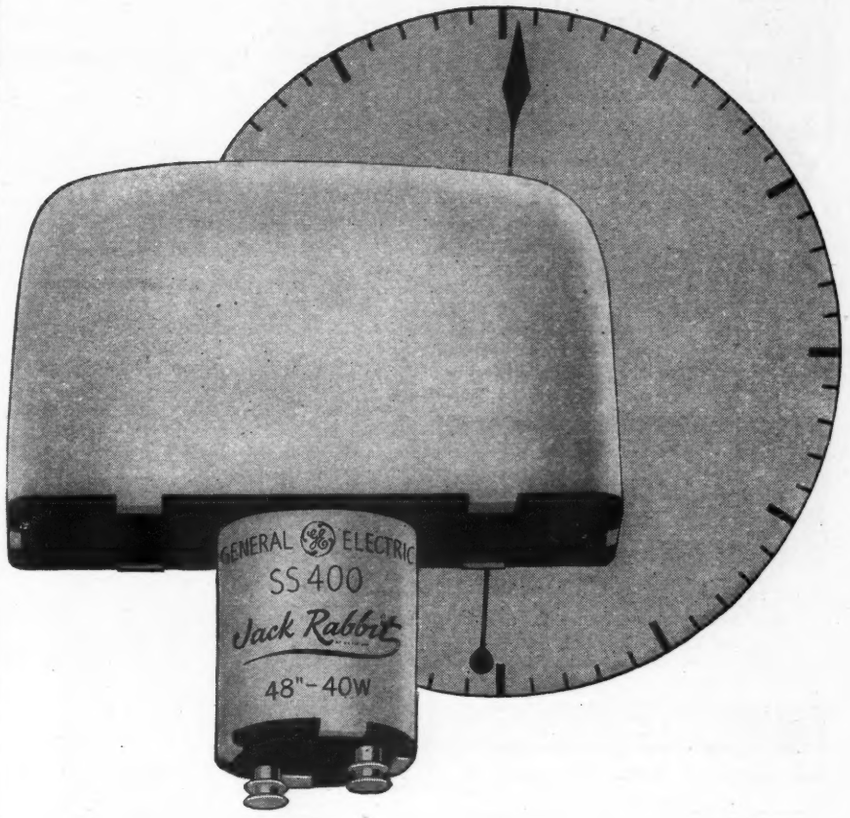
Illuminating Engineering Society—National Convention—Chateau Frontenac, Quebec, Canada, September 18–21.

International Municipal Signal Association, Inc. — Annual Meeting — Miami Colonial Hotel, Miami, Fla., October 14 to 17.

Rocky Mt. Chap—IAEI—City and County Bldg., Denver Col., October 8.

National Electrical Manufacturers Association — Annual Meeting — Marlboro-Blenheim and Claridge Hotels, Atlantic City, N. J., October 28 to November 2.

FOR A SPLIT-SECOND START



Equip Fluorescent Fixtures With G-E Jack Rabbit Starters

REG. U.S. PAT. OFF.

With the new G-E Jack Rabbit installed in your fluorescent lighting system, you have the advantage of split-second starting and protection against blinking for 40-watt fluorescent lamps. On top of that you have economy of operation. The Jack Rabbit, which is for use with conventional low cost ballasts, provides approximately 13 per cent greater over-all operating efficiency than high-voltage instant-starting ballasts.

This combination of features is exclusive with the Jack Rabbit, which is the reason why this new starter has attracted wide interest wherever fluorescent lighting is used. Your system will be improved and modernized with the Jack Rabbit — its quick, efficient starting and protection against dead lamp flickering are benefits of direct value to you.

For additional information about the Jack Rabbit write to Section G261-8, Appliance and Merchandise Department, General Electric Company, Bridgeport, Connecticut.

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TESTS ANY VOLTAGE...
100 to 550 Volts, A.C. or D.C.
Safely, Swiftly, Surely

THE NEON GLOW
LOCATES TROUBLE INSTANTLY
Indicates hot or grounded wires. Tells AC from DC. Far superior to ordinary clumsy test bulb. Indispensable in shop or home. The only pocket-size tester with PATENTED SAFETY FEATURE. Lifetime guarantee. List $1.50. Purchase thru regular electrical dealers. Pat. No. 1,778,883

For Quick Soldering

A small quantity applied to the joints to be soldered will, WHEN HEATED, flow and unite the parts the same as wire and bar solder No flux or soldering iron required. (Priority A-7 or better) 25c tubes; 1, 5, 10 and 25-lb. cans.

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MANUFACTURERS NEWS

G-E CHANGES

A. W. Gilmore has been appointed assistant to C. R. Pritchard, general sales manager of the appliance and merchandise department and will assist in connection with sales of construction materials from the Bridgeport, Conn., office. He returns from three years service as a lieutenant-colonel with the supply and service department of the Air Transport Command in Europe.

F. D. Crowther has resumed his position as G.E.'s lighting division sales manager.

F. O. CROWTHER

Recently released from the army with the rank of colonel, he holds the Legion of Merit and Bronze Star decorations.

E. H. Fritschel has been named manager of sales, tube division, electronics department, located in Schenectady, New York. He formerly was sales manager of transmitting tubes.

J. M. Lang has been appointed manager of the tube division of General Electric's electronics department with headquarters at Schenectady. He succeeds George W. Nevin who has resigned. Mr. Lang formerly was manager of the Ken-Rad division of the department with headquarters at Owensboro, Kentucky.

A revision of the construction materials sales districts has been completed as part of an overall company plan for more adequate coverage of construction materials distributors and the electrical trade. Under the new plan district offices have been opened in Philadelphia, Pa., and in Kansas City, Mo., increasing the number of districts and district managers from seven to nine. The revised organization is as follows: northeastern district, Boston, Mass., J. H. Newman, manager; New York district, New York, N. Y., J. O. Wetherbie, manager; Atlantic district, Philadelphia, Pa., W. E. Swenson, manager; Great Lakes district, Cleveland, Ohio, S. D. Hopper, manager; north central district, Chicago, Ill., G. E. Wickman, manager; southwestern district, Dallas, Tex., R. L. Snodgrass, manager, and Pacific district, San Fran-

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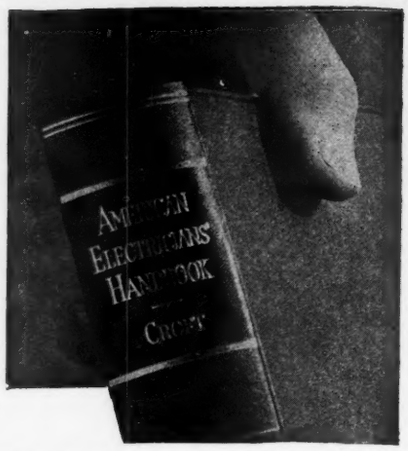
EVERY TYPE OF PRACTICAL ELECTRICAL JOB



Thousands of men have used previous editions of this famous handbook as a working guide of everyday usefulness. Now it is ready to help you too, in a big new 5th edition—600 pages larger—brought up to date — *more than ever the one great pocketbook of practical electricity for you.*

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THIS book is packed from cover to cover with the facts which every man engaged in electrical work needs to have constantly at hand. From clear explanation of the fundamentals of electricity to suggestions for remedying the troubles of electrical equipment, the information is the kind that helps practical electrical men select and install commercial electrical apparatus and materials intelligently for the performance of specific services, operate electrical equipment efficiently, and maintain it at high operating efficiency.

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Position .....EC 2-46

cisco, Calif., J. O. Dillingham, manager. No manager for the southeastern district, Atlanta, Ga., has been named since the recent death of O. F. Kypta. The new district set-up will necessitate reallocation of district representatives and distributors.

The General Electric Co. has purchased from the Reconstruction Finance Corp. a 58,000 square foot factory in Allentown, Pa., for the manufacture of electric appliances. According to present plans, 350 persons will be employed in this Pennsylvania plant.

TRUMBULL APPOINTMENTS

Announcement has been made of the appointment of Frank M. Oglee as manager of sales in the Norwood, Ohio, plant. Mr. Oglee was manager of the Atlantic sales district previous to this new assignment.

F. M. OGLEE

Mr. Oglee has had extensive sales experience in both the east and western sections of the country.

Effective January first, Howard S. Smith was named sales supervisor of farm and residential products. He has been active in the development and promotion of electric farm production equipment and is known in the poultry field by reason of his work with germicidal lamps, water warmers and brooders.

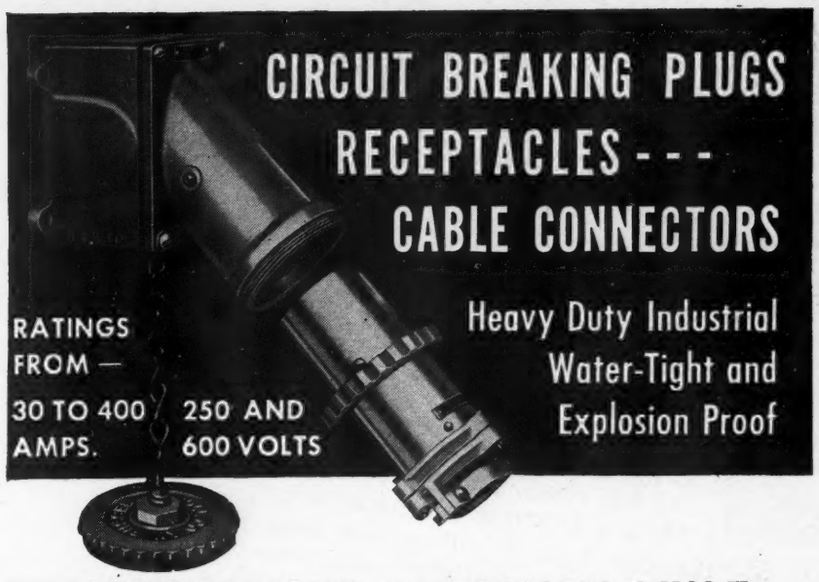
Robert M. Booth has been appointed assistant district manager for the New England states. His headquarters will be located in the Boston office at 378 Stuart Street.

J. S. Ingebretsen, formerly manager of the Boston office, has been appointed district engineer for the entire New England area.

W. C. Goodwin has been transferred to the southwestern district and will make his headquarters in Houston, Texas, as assistant to W. A. Edwards. Replacing Mr. Goodwin will be George R. Buckbee, formerly located in the Bridgeport-Stamford, Connecticut, area, who will now be located in Providence, R. I.

L. H. Johnson, formerly sales engineer at the Plainville factory on feeder distribution systems, takes up duties in the sales field assisting C. D. Munger, for the entire Connecticut area.

W. S. Parker, a native of New Hampshire, has been appointed territorial representative for that state as well as Maine,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FOR SAFE OPERATION

Positive grounding by means of housing and separate contact for safety circuit wire.

Polarized by means of contact arrangement and groove and key in housing. Impossible to insert plug incorrectly.

All contact surfaces are precision machined and adjusted for maximum contact pressure, reducing arcing to a minimum.

Arcing chamber is completely inclosed. Arc is extinguished before plug is completely removed.

FOR LOW MAINTENANCE

Contacts—free floating, self-wiping, stay clean and retain full contact pressure.

Sealed cable grip — no strain on connections. Excludes all dust and moisture.

Ground surfaces and durable oil-resistant gaskets.

Liberal space for wiring, quick and easy access. Facilitates inspection and servicing.

FOR EASE OF INSTALLATION

Substantial external lugs for easy mounting.

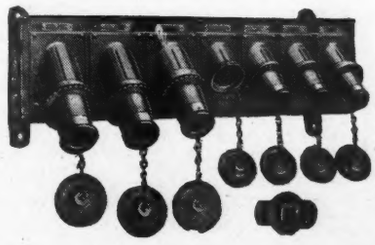
Boxes will accommodate a variety of conduit outlets to suit all job requirements.

Ample wiring space and substantial terminals make wiring easy.

Assembly of interior and contacts requires no special tools.

Interiors do not extend back of covers permits direct assembly to cabinets without internal interference.

A high degree of standardization and interchangeability of parts provides a wide variety of types and sizes to suit every requirement.



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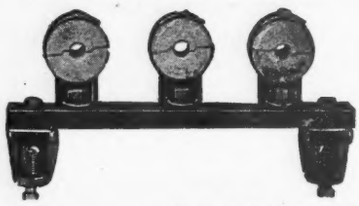

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ELECTRIC MFG. CO.
EAST PALESTINE OHIO

Vermont, and the territory north of Boston. He will operate from Manchester.

Arthur H. Soper, who has been located in the Philadelphia office of the Atlantic district, has submitted his resignation due to illness. Succeeding him is John J. Harrigan, from the factory at Plainville.

L. S. Poffinbarger has been transferred from Chicago to the St. Louis area and E. C. Thorsen has returned from military service to the Chicago district as district engineer for the organization.

Edward Flanagan has joined Trumbull, following his release from active duty with the Navy. He will cover Davenport, Iowa, and the neighboring territory.

G. D. Burrus, released from the Army Air Corps, has accepted the position of territorial representative in the southeastern district. He will be located in Atlanta with district manager H. S. Hill.

E. R. Graves, who has been located in the Atlanta office, has been assigned to the territorial section of Nashville, Tenn.

E. J. Burchell has been transferred from the Norwood plant sales division to the Norwood district territorial representatives' group.

NEW TITLES IN GRAYBAR

Gordon M. Colwill has taken over the duties of supply sales manager for the Graybar Electric Company at the executive headquarters in the Graybar Building, New York City. He formerly managed the supply department in the company's Detroit territory.

GORDON M. COLWILL

After nearly five years of military service, Lt. Col. Kenneth O. Hanson returns as the St. Louis manager of the power apparatus department.

The promotion of Melton P. Johns to managership of Graybar's St. Louis lamp and lighting division was announced January first. He succeeds William Goerisch who has been transferred to the New York general office.

Edward G. Jerrald returns to Graybar after his release from the service and becomes a territorial representative in southern Illinois.

Burton R. Cole assumed the duties of communication sales manager on January 15th, making his headquarters in New York City. Prior to a three year tour of duty with the Army Signal Corps, Mr. Cole managed the lamp, lighting and supply departments in the Seattle territory.

FARIES APPOINTMENTS

J. V. Everard, formerly advertising manager, has been appointed assistant general sales manager of the Faries Mfg. Co., Decatur, Ill.

E. V. Horrigan, formerly with Caterpillar Military Engine Co., has been appointed advertising manager.

Newly elected officers of the company include W. F. Masterson, vice president in charge of sales, and C. Hansen, vice president in charge of production.

Contracts have been let for a new factory building, 185 by 620 feet, equipped with the most modern machinery, fluorescent lighting and railroad siding for shipping.

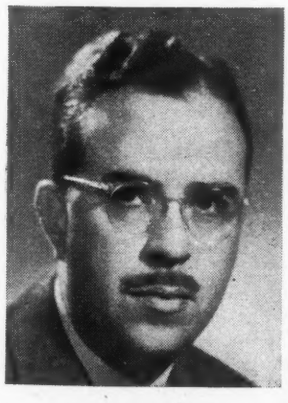
PITTSBURGH REFLECTOR ANNOUNCES APPOINTMENTS

Lon E. Russell and H. D. Siler are new appointees to the Pittsburgh sales office. Mr. Russell was formerly with the Billesby Construction Corp. of Chicago, and the Duquesne Light Company of Pittsburgh. Mr. Siler has been with the Pittsburgh Reflector Company since 1940 as Illuminating Engineer until his recent transfer to the sales department. Through the war years he worked in the government contracts division in the home office.

Charles L. Ellis, in the lighting field since 1929, has been appointed New York manager. He was formerly with Consolidated Edison as a lighting specialist and with the MacBeth-Evans division of the Corning Glass Works as lighting consultant. In 1942, Mr. Ellis was made lighting consultant in charge of the middle Atlantic states, which position he held until his appointment with Pittsburgh Reflector.

J. J. DAGGON IN CHARGE OF LELAND SALES

J. J. Daggon has been appointed vice president in charge of sales for the Leland Electric Co. of Dayton, Ohio. A company associate since 1930, he has served as east-



J. J. DAGGON

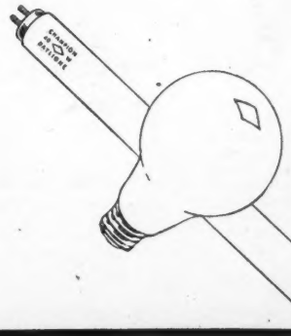
ern district sales manager and, for the past 3 years, as assistant to the vice president in charge of engineering. He holds both ME and EE degrees from Ohio State University.

WHEN YOU BUY
CHAMPION *Lamps*
HERE'S HOW MUCH MORE
YOU GET FOR YOUR MONEY

1 **Champion Quality**—the result of forty-six years of concentration on the manufacture of lamps for industrial service. Champion **Fluorescent** and ***Incandescent*** Lamps are guaranteed to *equal or exceed* Federal Specifications and backed by the production and quality control resources of one of the largest lamp producers in the industry.

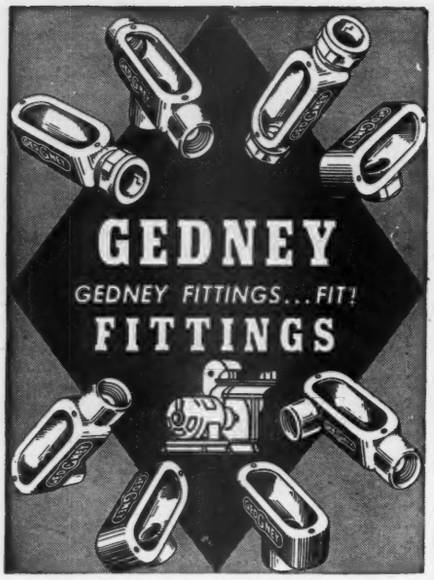
2 **Champion Economy**—the entire Champion manufacturing and distributing set-up is devoted to the job of getting lamps to you at minimum cost. When you standardize on Champion Lamps you can be certain of getting the most lighting and lamps for your money.

3 **Champion Service**—trained lighting experts in the field to help you on every lighting problem, and a carefully selected industrial distributor near your plant, ready and able to provide prompt, intelligent and economical attention to your lamp needs on the spot.



Try Champion Lamps and find out for yourself how much these extra advantages mean to you. Let us give you the name of nearest Champion industrial distributor.

CHAMPION LAMP WORKS
Lynn, Massachusetts
A DIVISION OF CONSOLIDATED ELECTRIC LAMP CO



GEDNEY Conduit Bodies and Fittings are available for every wiring need. Complete lines of both threaded and threadless fittings are included. All are carefully finished, protectively packed in metal-edge cartons, clearly marked for time saving on the job. GEDNEY fittings are Underwriters Laboratories approved. Write for catalog.

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SOLAR
Electrical Products

Quotation on request

SOLAR ELECTRIC CORPORATION
WARREN, PENNSYLVANIA

WESTINGHOUSE NAMES NEW MANAGERS

The appointment of Charles B. Kennedy as branch manager at Dayton, Ohio, has been announced. A graduate of the University of Dayton and a veteran of World War I, he spent 26 years as manager of merchandise and sales with various electrical concerns and a public utility company before joining Westinghouse. He has been the Dayton appliance manager for the past year.

W. E. Lee, formerly of Los Angeles and a sales engineer in the mining industries for the Westinghouse Corp., has been named manager of the company's Phoenix, Arizona, office.

C. J. Schutty who is being transferred to the company's Kansas City office.

Fred W. Bush has been promoted from assistant to the manager to assistant manager of the electrical department. A graduate of Georgia Tech, Mr. Bush started with the company in 1928 and became engineer's assistant in the electrical department in 1930. He became sales engineer in 1936 and in 1941 was named sales engineer-in-charge, transformer sales.

Also announced is the appointment of Frederick C. Ludington as manager of the firm's switchgear and control sections. Mr. Ludington joined Allis-Chalmers in 1923 and has been acting manager of these sections since the recent resignation of W. S. Edsall.

MITCHELL APPOINTEES

The Tru-Ad Division of the Mitchell Mfg. Co. at Los Angeles has announced the appointment of Clyde E. Allen as sales manager for the entire Pacific coast area served by the Los Angeles plant.

Herbert M. Rose, with a recent Navy honorable discharge, has been appointed Mitchell sales representative for Pittsburgh. Prior to the war he was the company's district manager for southern California, specializing in lighting sales.

SPANG-CHALFANT APPOINTEE

On January first, M. B. Squires was appointed manager of sales for all domestic and foreign distribution of Spang-Chalfant conduit products. Mr. Squires was formerly connected with the Central Tube Co. which was purchased by Spang-Chalfant in 1940.

RITTENHOUSE APPOINTMENT

The appointment of E. C. Dvorak as sales manager of the A. E. Rittenhouse Co. Inc., Honeoye Falls, N. Y., has been announced. Mr. Dvorak comes to Rittenhouse Chimes after eleven years with G. E. Since 1939 he has been sales manager of the G. E. range division, Bridgeport, Conn.

E. C. DVORAK

CROCKER-WHEELER SALES APPOINTMENTS

Frank E. Nutt has been named assistant sales manager of the Crocker-Wheeler Mfg. Co., Division of Joshua Hendy Iron Works, Ampere, N. J. He was replaced at his former post as manager of the company's Washington, D. C., office by A. M. R. Lawrence of Chevy Chase, Md. Since 1942 he has been associated with Crocker-Wheeler as N. Y. sales engineer and later as manager of the Washington office.

Mr. Lawrence, with the Westinghouse Machine Co. for 22 years in Pittsburgh and Washington, resigned as marine sales manager in 1937 to establish his own engineering office in Washington. In the fall of 1942 he joined the Maritime Commission, working with government agencies as a marine sales engineer.

ALLIS-CHALMERS ANNOUNCES PROMOTIONS

A. W. Kremser has been named branch manager of the Davenport, Ia., office of the Allis-Chalmers Mfg. Co., Milwaukee, Wis. With the company since 1924, he succeeds

JOHNS-MANVILLE ELECTS TWO VICE PRESIDENTS

Effective the first of the year, Johns-Manville announced the election, as vice presidents of the corporation, of L. M. Cassidy and T. K. Mial.

Mr. Cassidy was formerly a vice president of the sales corporation, a subsidiary of J-M, in charge of the building materials and general department. He joined J-M as an architectural representative in 1926 following his graduation from the Wharton School of Finance and Commerce of the University of Pennsylvania. In 1936 he was promoted to general merchandise manager and in 1940 was made vice president of the sales corporation and general man-

ager of its building materials department.

Mr. Mial, another former vice president in the sales corporation, was in charge of the power products and industrial department. He began work with the company as a Pittsburgh salesman in 1917. In 1922 Mr. Mial became manager of the Pittsburgh branch and later was appointed a division manager in Cleveland. In 1929 he was transferred to New York as manager of the company's eastern division and two years later became a vice president of the sales corporation. He is a graduate of North Carolina State College.

Louis R. Hoff, retiring after 45 years with J-M, has established himself as an independent consultant and will serve J-M in that capacity.

FORMICA APPOINTMENTS

Fred C. Walter, associated with the sales, advertising and product development department of the Formica Insulation Co., Cincinnati, Ohio, for 17 years, has been promoted to assistant sales manager of the company.

The Philadelphia territory, formerly operating as a branch of the New York office, now is a separate entity with Albert Lesberil managing this new direct factory branch.

The Atlanta territory has been combined with that of Charlotte, N. C., with offices in both cities. Clarence Kuester who has been associated with Fason Kuester in charge of the Charlotte office is moving to Atlanta to take charge of the Formica sales work in the Georgia area.

Kenneth Pitt, until recently associated with the home office and plant purchasing department, has gone to Boston to become affiliated with Francis Murdock, Boston representative.

•

E. A. Taylor joins **Allied Control Co., Inc.** as general sales manager, coming from the General Electric Co. J. S. Speer has been appointed eastern sales manager. Hugh M. Noble will be western sales manager with headquarters at Chicago.

•

The Reynolds Metals Company has acquired two gigantic government-owned plants; Hurricane Creek, Arkansas—the world's largest alumina plant—and the aluminum reduction plant at Jones Mill, Ark., 20 miles from Hurricane Creek.

•

The Standard Transformer Co. of Warren, Ohio, has recently appointed several new agencies as their representatives. They are: I. E. Cope and Co., Thomas Building, Dallas 1, Texas, serv-

Glareless!

SIGN ILLUMINATION FROM BELOW . . .

THE CLOSELITE . . . another original Goodrich development, provides uniform close-up illumination of signs without reflected glare.

This specially shaped reflector gives accurate light control, which produces a high intensity of illumination on the sign and increases legibility due to the complete elimination of reflected glare. Mounted closely beneath the sign, the Closelite does not appear in the field of vision to obscure any part of the sign at normal view.

In the complete Goodrich line, you'll find hundreds of sizes and styles of reflectors to answer every need in industrial and outdoor illumination. Complete information on request.

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TORK

TURN ANYTHING ELECTRICAL ON & OFF REGULARLY

The TORK CLOCK CO., Inc.
MOUNT VERNON, NEW YORK

DRILL CONCRETE THE EASY WAY

WODACK "DO-ALL"
ELECTRIC HAMMER AND DRILL

Saves time and labor installing expansion anchors. Two motions—reciprocal for hammer drilling—rotary for twist drilling. Drills masonry to 1¾", dia., metal ⅜". Easy to maintain. Universal motor, runs direct from lamp socket. Weighs 15 lbs. Star drills in 17 diameters. Also chisels, bull points, etc. Ask for bulletin.

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4628 W. Huron St. Chicago 44, Ill.
Telephone AUstin 9866

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KUEHL FISH TAPE GUN

A Pusher . . . A Puller
A Reel . . . A Fish Tape

The fish tape is pushed, pulled, wound and unwound by simply pumping the handle. One man can pull as much as three with the Kuehl Fish Tape Gun. It offers a 3 to 1 mechanical advantage.
Write for descriptive bulletin.

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Silver Sodering, Welding
L. B. ALLEN CO., INC.
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Burned Out or Broken Electric Heating Elements

repaired with NICHROCITE PASTE. Simply overlap ends, apply paste, turn on current. Used by utility companies, etc. Family size, $1.00, 4 oz. size $2.50. Satisfaction guaranteed.

ARMSTRONG Mfg. Co., Box 861F, Minneapolis, Minn.

ing Oklahoma and N. E. Texas; The Klass Co., Wesley Temple Building, Minneapolis, Minn., serving North Dakota and western Wisconsin; and Southwest Sales and Service Co., C. P. Couch, 310 Commercial Nat'l. Bank Building, Shreveport 24, La., serving Arkansas and Memphis, Tenn. The Ark.-Tenn. area will also be served by a branch office, the Southwest Sales and Service Co., Curtis Stout, 1808 Beechwood Road, Little Rock, Ark.

•

Paul L. Lindsay has been named general staff manager in charge of sales for the **American Steel and Wire Co.**, a U. S. Steel subsidiary. In addition to other duties, Mr. Lindsay will assume the responsibilities of V. H. Farr, assistant general manager of sales, who retired after 45 years of service with the company. Mr. Lindsay left Carneigie-Illinois Steel in 1934 to enter the Wire Company and went to Cleveland as chief industrial engineer in the operating department in 1936. He was later transferred to the office of the president and in 1943 became general assistant to the president.

•

H. C. Stark of Ridgewood, N. J., formerly field engineer in the New York branch of **Square D Company**, Detroit and Milwaukee, will be manager of the company's new branch sales office at 1060 Broad St., Newark, N. J.

H. W. Wharton of Keyport, N. J., will be field engineer for the office. The new branch will handle all company activities for the New Jersey territory north of Monmouth County.

•

Acme Electric and Mfg. Co. of Cuba, N. Y., has appointed two new sales representatives; the Hopper and McCoy Company of Atlanta, Ga., and the L. W. Sloan Company of St. Louis, Mo. William E. Hopper and H. H. McCoy will represent the company in Florida, Georgia, Alabama, South Carolina, Eastern Tennessee and North Carolina. Loren W. Sloan will cover the St. Louis area.

•

The C. M. Hall Lamp Co., Detroit, recently announced the appointment of Harry S. Walker as manager of the Radiant Heat division. He replaces Thomas P. Cusack, Jr., newly appointed manager of the sales development division for the company. For the past eight years, Mr. Walker has represented Westinghouse on various engineering and sales assignments in New York, Pittsburgh, Toledo, Louisville and Detroit.

It's YOUR future—Make the most of it!

Start now to earn the bigger pay in electrical repair

Was there ever such an opportunity to get started in electrical maintenance and repair—and at top-notch wages? Are you ready—with experience and ability—to cash in on it? Others are getting just the sort of background needed—quick! practical!—to handle the great variety of electrical maintenance and repair work TODAY—from this well-known electrical library. You can too!

Electrical Maintenance and Repair Library

5 volumes, 2042 pages, 1721 illustrations

Gives you the "know-how" to tackle any wiring or motor job. Five books show you HOW—to install all types of motor and generator units—to inspect and repair motor starters and generators—to diagnose motor and generator troubles—to figure new windings for old cores, DC and AC windings—to test armature windings, test induction motors, etc., etc. The new book is full of trouble-shooting charts that show quickly symptoms, causes, specific remedies, etc.

Includes trouble-shooting book

Now in addition to four well-known practical books on all details of testing, connecting, rewinding, installing and maintaining electrical machinery, the Library includes Stafford's *Troubles of Electrical Equipment*, a handy book giving helpful maintenance information, special trouble-shooting charts, explanations of symptoms and causes of machinery troubles, specific remedies, etc. This revised library gives you the ability to handle bigger jobs with surety of results.

10 DAYS' EXAMINATION
Easy monthly payments

We want you to examine this Library for 10 days. If you don't want them at the end of that time, there's no obligation to keep them. On the other hand if you decide you want the help these books can give, start the small monthly payments then, and in a short time the books are yours, right while you have been using them. Send the coupon today.

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Send me Electrical Maintenance and Repair Library, 5 volumes for 10 days' examination. If I find the books satisfactory, I will send you $1.00 in 10 days, and $2.00 a month until $15.00 has been paid. Otherwise I will return the books postpaid.

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In Canada: Mail to Embassy Book Co., 12 Richmond St. E., Toronto 1.

Allen-Bradley Co., Milwaukee, Wis., announces the appointment of Muth-Richards Co., 1426 Broadway, Seattle 22, Wash., as its new representative in the Seattle area. Muth-Richards Co. is a newly organized company headed by Lawrence Muth and Willis C. Richards.

•

J. F. Funk, formerly president and general manager of Henry and Wright Mfg. Co., Hartford, Conn., has been made general manager of the **Fairmount Tool and Forging Co.**, 10611 Quincy Ave., Cleveland.

Ernest Spuhler, formerly asst. sales manager, has been made general sales manager and Leo V. Anthony is the new asst. sales manager.

•

Announcement is made of the formation of **Perfect-Line Mfg. Corp.** of Hicksville, N. Y., to manufacture electrical equipment including ventilating and lighting units. Alfred Robbins, president and chief engineer, comes to the Perfect-Line organization from Burndy Engineering Co. John M. Goettleman has been named plant superintendent.

•

Harold W. Roher, until recently manager of transmitting tube sales for Westinghouse, has joined the sales staff of **Machlett Laboratories, Inc.**, Springdale, Conn. He will be in charge of the renewal sales department and will also administer the company's operation under its RFC Agency Agreement relative to the sales of surplus government electron tubes.

•

Major H. H. Seay, Jr., returns from the army to the **Bell Sound Systems, Inc.**, Columbus, Ohio, as executive vice president and general manager. During the past four years he has served at Wright Field and with the Spokane Air Technical Service Command as chief of radio and radar equipment.

•

James Adair, for the past nine years a sales engineer with Westinghouse, moves to **Star Electric Motor Co.**, Bloomfield, N. J., to represent that company in the New Jersey industrial area.

•

A new 48,000 sq. ft. building is being erected alongside the main plant of the **Reliance Electric and Engineering Co.**, Cleveland, Ohio.

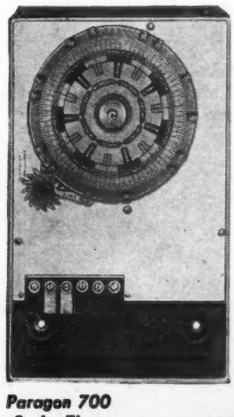
"Mr. Tops," The Paragon Symbol of Top Quality.

LET "MR. TOPS" CONTROL YOUR TIMING of

***Automatic* HEATING, VENTILATING, LIGHTING, PUMPING OR FLUSHING OPERATIONS**

Paragon 700 Series Time Switches are equipped with 6" calendar dials which make one complete revolution every 7 days. Dial trippers can be independently set for different daily ON and OFF schedules. Settings can be made in advance for an entire week. Any day or days operations may be omitted entirely on a pre-set program.

Each day of week clearly separated from other days; graduated into hours and half hours; day and night distinctly separated. Operations from ON to OFF or from OFF to ON can be set as close as three hours apart and can be separately adjusted throughout each 24 hour day in the week.



Paragon 700 Series Time Switch

Write for a complete engineering bulletin.

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710 Old Colony Building
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Paragon *Chicago*
BUILDERS OF ELECTRICAL EQUIPMENT SINCE 1905

PROMPT SERVICE FROM
The Jiffy Line
"Jiffy" SNAP-IN BLANKS

"Jiffy" Knockout Seals are safe, cost less and are easy to install. Only one piece, they snap into place. No tools necessary.
"Jiffy" ADJUSTABLE HOLE CUTTER

Cuts clean round holes quickly, easily, and accurately through steel plates, boxes, iron, fibre and other materials. Ratchet wrench and spring pressure make it easy to operate in corners and cramped positions. Also available for use with drill press.
"Jiffy" SOLDER DIPPER

A practical tool for electricians. Lasts a lifetime. It doesn't spill or waste solder, or burn the insulation.
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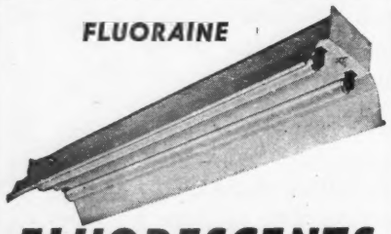
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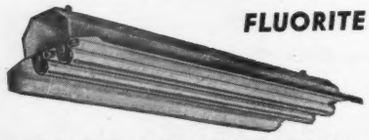
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4223 W. Lake St., CHICAGO, ILL.

CALL PLAZA 2300 FOR CONTRACTOR SERVICE

[FROM PAGE 78]

have practically doubled since the radio program was put on.

Telephone Answering Service maintains a 3 by 5 card file of the membership, classified by zones and communities. Operators at the Exchange use a rotating system of member referrals within each zone or community. Each member within a zone is thus assured of an equal number of referrals. If service is required by a customer of a type for which no contractor in the customer's zone is listed, the operator uses the membership list in an adjoining zone.

When a customer call comes in to the Exchange, the operator fills out a standard form, giving the customer's name, address, zone number, and telephone number. She looks up the electrical contractor's name, qualified to do the work involved, and gives this contractor's name, address and telephone number to the customer. The contractor's name is then written on the back of the form, and the form time-stamped (Fig. 4). These forms are delivered to the Association at the end of the month.

Monthly calls to PLAZA 2300 are now running about 500 percent above its average for the first few months. Membership has increased 300 percent in the last year. Statistics over a two-year period now offer a sound basis for future plans. Participating members are the most enthusiastic boosters. The Association estimates that the exchange has been responsible for over $100,000 in new business for participating members during 1945, and the rate is increasing Three participating members, selected at random, had typical experiences to relate.

1. *Noone Electric Company.* Business from Exchange referrals averages about $225 per month. His policy is to be on the job within one hour from the time the call is received.

2. *Herstein Electric Company.* One small service call received through the Exchange from a store resulted in a $1,000 lighting fixture order, plus a complete rewiring job. Approximately 25 percent of the exchange calls to this contractor result in return calls from the customer.

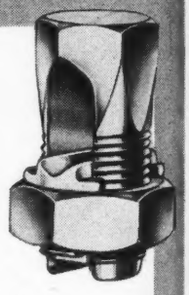
3. *Earl R. Westendorf.* He closed his electrical contracting business during the war, to devote his full time to war work. Mr. Westendorf reopened after V-J Day, and immediately joined the Exchange. One call received the day he was interviewed was from a home owner whose doorbell wouldn't work. He received a wiring job for $35.00 through prompt service on the doorbell.

MR. CONTRACTOR:
HUNDREDS OF THOUSANDS OF DOLLARS ARE GOING TO BE INVESTED IN NEW SERVICE STATION LIGHTING. CAPTURE THIS BUSINESS WITH
Revere
THE COMPLETE QUALITY LINE

Revere Eliptor 3800 Series—300, 500, 750, 1000 and 1500 watt floodlight — neat, trim, streamlined. Effective, uniform overall lighting.
REVERE HINGED FLOODLIGHT POLE
The greatest boom to efficient floodlighting. Floodlights may be cleaned and serviced from the ground. No ladders — no dangerous climbing. Available in three heights — 20, 24 and 30 feet mounting height.
THE REVERE TRIANGULAR FLOODLIGHT

The only floodlight of its kind that throws a definite 90° pattern — concentrates light on station area only. No spilled light on neighboring property or street.

Write for literature and prices.
REVERE ELECTRIC MFG. CO.
6017 Broadway — Chicago 40, Ill.

Conductor Fittings

Service Connectors of all sizes and types —Yoke - and - Nut Type from No. 10 to 1,000,000. Also Service Entrance Connectors, Service Post and special connectors.
Penn-Union also makes a *complete* line of Tee Connectors; Cable Taps; Straight, Parallel, Elbow and Cross Connectors; Bus Supports; Grounding Clamps, Lugs, etc. etc. *Leading users have found that "Penn-Union" on a fitting is their best guarantee of Dependability.*
PENN-UNION ELECTRIC CORP.
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PENN-UNION

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(See ¶ on Box Numbers.)

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PROPOSALS, 50 cents a line an insertion.

INFORMATION:

BOX NUMBERS in care of any of our New York, Chicago or San Francisco offices count 10 words additional in undisplayed ads.

DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

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AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches—to a page.

NEW ADVERTISEMENTS received by 10 A.M., February 21st will appear in the issue of March, subject to limitation of space available.

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ESTIMATOR-ENGINEER: Age 26 to 36. Possessing supervisory and sales ability for well established midwestern electrical contracting firm; to estimate wiring jobs for industrial, commercial and institutional type buildings. State age, education, experience, references and salary expected. Good opportunity for right man. P-362, Electrical Contracting, 520 N. Michigan Ave., Chicago 11, Ill.

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MANUFACTURERS—ATTENTION. A man of 25 years electrical construction experience as a contractor, estimator, superintendent, and journeyman electrician, with an ideal contact in the architectural, engineering, construction and jobbing field, wishes to represent one or two manufacturers of repute in Minnesota and the adjoining states. RA-361, Electrical Contracting, 520 N. Michigan Ave., Chicago 11, Ill.

FEDERAL ELECTRIC PRODUCTS COMPANY

50 Paris St., Newark, N. J.

Offers an unusual sales and engineering opportunity in the home office to men experienced in motor controls, safety switches and panelboards. If not thoroughly experienced as sales manager, a qualified man will be trained; adequate salaries will be paid.

Write attention of Mrs. E. Palmer, giving complete background

February Special

325 NEW 3 H. P. MOTORS

Louis Allis. Frame 225. 220 V.-60 Cycle-3 Phase. 1800 R.P.M. Splash proof. Ball Bearing. Double End Shaft. Tropical ins. Price each, F.O.B. Rochester, N. Y. $82

MOTORS, GENERATORS, TRANSFORMERS BOUGHT & SOLD

For prompt action, wire specifications collect

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Advertising In This Issue

Acme Electric & Mfg. Co. 156
*Adam Electric Co., Frank 20
*Aerovox Corporation 162
All-Bright Electric Co. 57
*Allen Co., Inc., L. B. 188
*Allis-Chalmers Mfg. Co. 5, 6, 7
*All-Steel-Equip. Co. 26
Aluminum Co. of America 91
*American Coach & Body Co. 4
*American Steel & Wire Co.....58, 59
*American Transformer Co. 13
*Anaconda Wire & Cable Co. 66
*Appleton Electric Co. 2
Armstrong Mfg. Co. 188
Arrow-Hart & Hegeman Elec. Co.. 98
*Associated Projects Co. 180
*Auth Electrical Specialty Co. 169
Automatic Electric & Mfg. Co. 184

Bakelite Corp. 15
*Bell Sound Systems, Inc. 170
*Benjamin Elec. Mfg. Co. 112
Blackhawk Mfg. Co. 142
Brach Mfg. Corp., L. S. 182
*Briegel Method Tool Co. 131
Bryant Electric Co. 28
*BullDog Electric Products Co..... 43
*Burndy Eng. Co., Inc. 17
*Bussmann Mfg. Co. 122, 123

Century Electric Co. 117
Certified Starters 141
*Champion Lamp Works 185
Chase Shawmut 48
Chelsea Products, Inc. 24
*Chicago Transformer Div. of Essex Wire Corp. 167
Clark Co., Robert H. 138
Clark Controller Co. 106
Crescent Ins. Wire & Cable Co. .. 163
Crouse-Hinds Co. 25
*Curtis Lighting, Inc. 108
*Cutler-Hammer, Inc. 104

*Davis Transformer Co. 153
*Day-Brite Lighting, Inc. 150, 174
*Dolph Co., John C. 136
*Dow Corning Corp. 12

Economy Fuse & Mfg. Co. 36
*Efficiency Elec. & Mfg. Co. 130
Electric Equipment Co. 191
Employment 191

*Fairbanks, Morse & Co. 125
Federal Electric Products Co...147, 191
Federal Telephone & Radio Corp.. 21
*Feedrail Corp. 49
*Frankel Connector Co. 160
*Fullman Mfg. Co. 173

*Gedney Electric Co. 186
General Cable Corp. 110, 111
*General Electric Co., (Bridgeport) Back Cover, 40, 181
*General Electric Co. (Nela Park) 134, 135
*General Electric Co. (Schenectady) Inside Front Cover, 9, 52, 171
General Luminescent Corp. 168
Goodrich Chemical Co., The B. F. 50, 51
Goodrich Electric Co. 187
*Graybar Electric Co. 68
*Greenlee Tool Company 175
Guth Co., Edwin F. 44

Harnischfeger Corp., P. & H. 10
*Hazard Ins. Wire Works Div...29, 45
*Holdenline Co. 96
Howell Electric Motors Co. 56
*Hullhorst Micro Tool Co. (Div. of Toledo Standard Comm. Co.)... 160

*Ideal Commutator Dresser Co. 55
*Illinois Electric Porcelain Co. 46
*Ilsco Copper Tube & Products Co. 182
Independent Pneumatic Tool Co... 33
*Insulation and Wires, Inc...94, 120, 127
International Register Co. 148

*Jefferson Electric Co. 100
*Johnson Bronze Co. 129

Kahn Mfg. Co., Inc. 19
*Klein & Sons, Mathias 146
Kondu Corp. 166
Kuehl & Son, D. S. 188

*Leader Elec. Mfg. Corp. 27
*Lint, Clyde W. 190

Machine-Craft Mfg. Co. 174
*McGill Mfg. Co. 157
McGraw-Hill Book Co.....182, 188
*Metropolitan Device Corp. 1
*Metropolitan Elec. Mfg. Co. 24
Miller Co. 16
*Minerallac Electric Co. 190
*Mitchell Mfg. Co. 92, 93
Monarch Fuse Co. 140
Multi Electric Mfg. Co. 190
*M & W Electric Mfg. Co. 184

National Elec. Products Corp. 164
North American Electric Lamp Co. 178
Norton Co., Inc., Cam 191

*Okonite Co. 29, 45
*Onan & Sons, D. W. 168
*Overbagh & Ayres Mfg. Co. 179

*Paine Co., The 132
Paragon Electric Co. 189
Pass & Seymour, Inc. 162
*Pelham Elec. Mfg. Co. 128
*Penn-Union Elec. Corp. 190
Pittsburgh Reflector Corp. 11
Pryne & Co., Inc. 184
*Pyle-National Co., The 132

*Quadrangle Mfg. Co. 152

Radio Corp. of America 158
Reading Electric Co., Inc. 172
*Reliance Automatic Lighting, Inc.. 172
Republic Steel Corp. 22, 23
*Revere Elec. Mfg. Co. 190
*Ridge Tool Company 8
*RLM Standards Institute, Inc. 61
Robbins & Myers, Inc. 31
*Rockbestos Products Corp. 34
*Roebling's Sons Co., John A....38, 39
Royal Electric Co. 161
*Russell & Stoll Co. 183

*Sangamo Electric Co. 32
Searchlight Section 191
Simplex Wire & Cable Co. 64
Smith Iron Works, A. L. 37
*Solar Electric Corp. 186
*Sorgel Electric Co. 149
*Spang-Chalfant 102
Speedway Mfg. Co. 130
*Square D Company. Inside Back Cover
*Standard Transformer Co. 41
Steel & Tubes Division 22, 23
Stockwell Transformer Corp. 153
*Superior Carbon Prod. Co., Inc. .. 131
*Sylvania Electric Products, Inc.... 54
*Syntron Company 180
Syracuse Surplus Co., Inc. 191

Tal's Prestal Bender, Inc. 170
Thomas & Betts 144
*Toledo Standard Commutator Co.. 160
*Tork Clock Co. 188
Trico Fuse Mfg. Co. 129
*Trumbull Electric Mfg. Co. 53

Union Insulating Co. 176
*United States Rubber Co...35, 154, 155
*United States Steel Corp. 58, 59

Virden Co., John C. 143

Wagner Electric Corp. 121
Wakefield Brass Co., F. W. 42
War Assets Corp. 191
*Ward Leonard Electric Co. 176
*Ware Brothers, Inc. 119
*Westinghouse Electric Corp. (Lighting Division) 139
*Weston Elec'l Instrument Co. 18
*Wheeler Reflector Co. 177
Where To Buy 188
Wiremold Company 30
Wodack Elec. Tool Co. 188
*Wurdack Elec. Mfg. Co., Wm..... 47

Youngstown Sheet & Tube Co. 14

Zinsco Electrical Products 133

★ These companies have supplied additional buying information on their products in the 1946 edition of the Electrical Buyers' Reference

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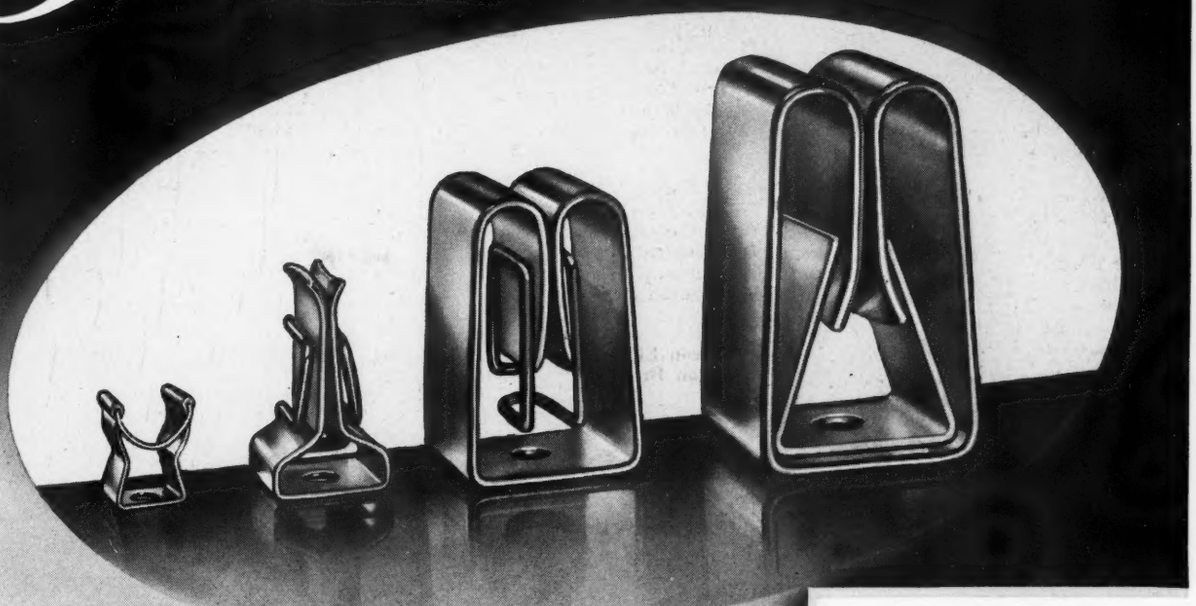

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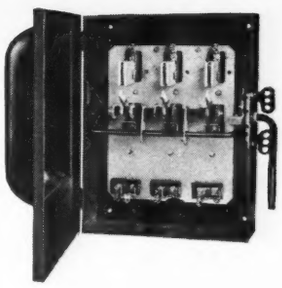

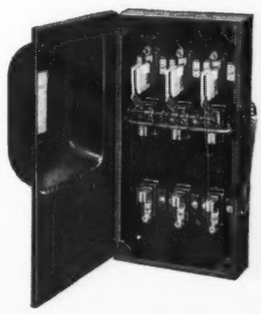

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